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CONTENTS

TYPES OF THE AMPHIBIAN AND REPTILIAN GENERA PROPOSED BY LAURENTI IN 1768. *By Leonhard Stejneger* 133

DESCRIPTION OF A NEW PHYLLODACTYLUS FROM MEXICO, WITH REMARKS ON THE STATUS OF *P. tuberculosus*. *By Walter Mosauer*.....141

VARIATIONS IN THE NUMBER OF VERTEBRAE OF THE SARDINE, *Sardinops caerulea* (GIRARD). *By Frances N. Clark*.....147

A REVISION OF THE GENUS *Icelinus* JORDAN. *By Rolf L. Bolin*.....151

A NEW SPECIES OF *Cyprinodon* FROM LAKE EUSTIS, FLORIDA. *By A. F. Carr, Jr.*.....160

ICHTHYOLOGICAL NOTES—Observations on the Breeding of the Lawyer, *Lota maculosa, by Alvin R. Cahn:* p. 163.—A Southern and Eastern Record of Two Pacific Flying Fishes, *Cypselurus californicus* and *altipennis, by J. T. Nichols and C. M. Breder, Jr.:* p. 166.—On a Fossil Flying Fish from Canada, *by Leo S. Berg:* p. 166.—Some Habits of *Amphiprion* in Relation to Sea Anemones, *by Albert W. C. T. Herre:* p. 167.—Occurrence of Three Species of Anadromous Fishes on the Nova Scotian Banks during 1935 and 1936, *by Vadim D. Vladykov:* p. 168.

HERPETOLOGICAL NOTES—Reptile Records from Stafford County, Virginia, *by W. Gardner Lynn:* p. 169.—A Cannibalistic Hog-nose Snake, *by Arthur M. Greenhall:* p. 171.—*Aneides flavipunctatus* in Burnt-over Areas, *by Wallace F. Wood:* p. 171.—Some Observations on *Xantusia vigilis* Baird, *by Edna M. Fisher:* p. 172.—The Northward Occurrence of *Bufo californicus* in California, *by Loye Miller and Alden H. Miller:* p. 176.—Courting Behavior of Some Western Lizards, *by Sherwin F. Wood:* p. 177.—Notes on Some Habits of *Terrapene carolina* (Linné), *by Randle C. Rosenberger:* p. 177.

REVIEWS AND COMMENTS—Georg Wilhelm Steller: Leonhard Stejneger, *by T. Barbour:* p. 178.—The Reptiles of North America: Raymond L. Ditmars, *by Howard K. Gloyd:* p. 179.

EDITORIAL NOTES AND NEWS—Summary of the 1936 Meeting: p. 181. Herpetological News Notes: p. 184. Ichthyological Items: p. 184.

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Types of the Amphibian and Reptilian Genera Proposed by Laurenti in 1768

By Leonhard Stejneger

Linnaeus in his *Systema Naturae*, both the tenth edition (1758) and the twelfth (1766), included in the class Amphibia three orders which he named *Reptiles, Serpentes* and *Nantes*. His contemporaries and subsequent authors nearly unanimously removed the latter group from the amphibians and added it to the fishes. In the remaining two orders he recognized 10 genera as follows:

REPTILES		SERPENTES	
1 *Testudo*	3 *Lacerta*	1 *Crotalus*	3 *Coluber* 5 *Amphisbaena*
2 *Draco*	4 *Rana*	2 *Boa*	4 *Anguis* 6 *Coecilia*

When it is realized that under *Lacerta* he included both the crocodiles and the salamanders, it must be admitted that the arrangement was very artificial. It was, nevertheless, accepted by most writers until the end of the eighteenth century.

Two years after the publication of the 12th edition of the *Systema Naturae*—there appeared in Vienna a small book (216 octavo pages) entitled:

> Josephi Nicolai / Laurenti / Austriaci Viennensis /
> Specimen / Medicum, / exhibens / Synopsin Reptilium /
> Emendatam / cum experimentis circa venena / et
> Antidota Reptilium Austriacorum. / [Vignette]—Viennæ, /
> Typ. Joan. Thom. Nob. de Trattnern, / Cæs. Reg. Aulæ
> Typogr. et Bibliop. / —1768.

The book falls into two quite distinct parts, the first, embracing 110 pages, a systematic descriptive part simply headed "Classis Reptilium" (p. 19), and a second part (pp. 111–214) with the following heading: "Historia Reptilium Austriacorum, continens singulae speciei differentiam, descriptionem et instituta circa venena experimenta." It is accompanied by five folded copper-engraved plates with 19 figures representing Austrian amphibians and reptiles.

Only the first part interests us here. In it Laurenti[1] divides the Class Reptilia into three orders, Salientia, Gradientia and Serpentia, and these three again into 35 genera, some of which had already been indicated by Gronovius. The order Salientia contains the toads and frogs; the Serpentia embraces snakes and legless lizards and amphibians; and although the Gradientia still includes the salamanders, lizards and crocodiles, the arrangement is a distinct advance on that of Linnaeus. The great improvement consists in the large number of new genera adopted. Nevertheless I know of a single author only among his early successors who accepted his classification in practically all its details, including his generic nomenclature, viz., Aug. Joh. Georg. Carl Batsch in his two-volume "Versuch einer Anleitung zur Kenntnisz und Geschichte der Thiere und Mineralien."[2]

[1] The real author is said to have been Winterl, who later became professor of Chemistry at Pest, Hungary, and who, because of financial difficulties during his student days, sold the manuscript to Laurenti (Fejérváry, Verh. Zool. Bot. Ges. Wien, 1917: 175).

[2] Jena, 1788. Batsch, however, calls the class Amphibia, and for the four orders, or "families" as he calls them, he uses the name Testudines, Batrachi, Lacertae and Serpentes. Laurenti, it is true, did not mention the chelonians, but that may have been because he had no changes or additions to the Linnean system to propose, as it is not likely that he considered them as belonging to some other "class."

With the increasing improvement in herpetological science towards the end of the century which made necessary the splitting up of the Linnaean genera, Laurenti's work was more or less—in many cases apparently intentionally —passed over in silence. Some of his generic names were applied in a different sense, other generic divisions which could not be ignored were given new designations, with the result that in recent years, when the strict application of the law of priority has necessitated the acceptance of the Laurentian names, considerable confusion has arisen as to the correct application of the latter. Generic type species have in many cases been erroneously designated for his generic names, others have remained type-less till the present time.

In order to correct previous errors[3] in such type designations and to prevent future ones the following survey was undertaken.

Genus I: PIPA, p. 24

Type *Pipa americana*, p. 25, both by monotypy and tautotypy, the species having for synonym Linnaeus' *Rana pipa* (Syst. Nat., 10 ed., vol. 1, 1758: 210).

Genus II: BUFO, p. 25

Contains 13 species, among them *Bufo vulgaris*, p. 28, a synonym of Linnaeus' *Rana bufo* (Syst. Nat., 10 ed., vol. 1, 1758: 210), which therefore is the genotype of *Bufo* Laurenti by absolute tautonymy.

Genus III: RANA, p. 29

A Linnaean generic name (*Rana* Linnaeus, Syst. Nat., 10 ed., vol. 1, 1758; p. 210). Genotype subsequently designated by Fleming (Philos. Zool., vol. 2, 1822: 304): "The common frog" = *Rana temporaria* Linnaeus (*op. cit.*: 212), of which Laurenti's *Rana muta*, p. 20, is a synonym.

Genus IV: HYLA, p. 32

This generic term was applied by Laurenti to nine nominal species, several of which are of disputed identity. The name *Hyla* was for the first time applied by him to the tree frogs and is not found in any of the previous zoological literature either as a generic or as a specific appellation. The genotype therefore depends on subsequent designation. Fitzinger in 1843 (Syst. Rept.: p. 30) designated *Hyla boans* of Daudin as the type, but as this species is not included among Laurenti's original nine species, the designation is void. As a matter of fact I have found none of these definitely and specifically denoted as type until 1907 when in the *Herpetology of Japan* (p. 75) I so designated Laurenti's *Hyla viridis* (p. 33) which is a synonym of Linnaeus' *Rana arborea* (Syst. Nat., 10 ed., vol. 1, 1758: 213).

Genus V: PROTEUS, p. 35

Laurenti under this genus includes three species, viz., *Proteus raninus* (p. 36) from Surinam; *Proteus tritonius* (p. 37) from the Etscher Alp, Austria; and *Proteus anguinus* (p. 37) from the Zirknits Lake, Carniola. He characterized the genus as having lungs and gills at the same time.

Curiously enough he placed the *Proteus raninus* in Ordo I, Salientia, and the two other species in Ordo II, Gradientia, because the former has "Pedes postici saltatorii," while the latter are provided with "pedibus posticis gradientibus."

[3] "Errors," or perhaps better, "unconformities" with the present International Rules of Zoological Nomenclature.

Proteus raninus was soon recognized as the larva of Linnaeus' *Rana paradoxa,* and *Proteus tritonius* as that of Laurenti's own *Triton alpestris.* Merrem, in 1820 (Tent. Syst. Amph.: 188), leaving the genus practically monotypic, substituted *Hypochthon* for *Proteus* under the erroneous impression that *Proteus* was preoccupied, thus establishing *P. anguinus* as the genotype of *Proteus* under the substitute name *Hypochthon laurentii* (Int. Code, art. 30, II f).

Genus VI: TRITON, p. 37

Comprises 11 species. Of these *Triton cristatus* Laurenti (p. 39) was designated in 1843 by Fitzinger (Syst. Rept.: 34) as the genotype. Rafinesque in 1815 (Anal. Nat.: p. 78) substituted *Triturus* for Laurenti's *Triton* because the latter was preoccupied by Linnaeus for a mollusk. *T. cristatus,* therefore, becomes the genotype for *Triturus* (Int. Code, art. 30, II. f.)

Genus VII: SALAMANDRA, p. 41

In this genus Laurenti recognized 6 species, but as his *Salamandra maculosa* (p. 42) equals Linnaeus' *Lacerta salamandra* (Syst. Nat., 10 ed., vol. 1, 1758: p. 204) it becomes the genotype by tautonymy.

Genus VIII: CAUDIVERBERA, p. 43 [err. typ. 34]

Laurenti includes two species in this genus, *C. aegyptiaca* based on "Seba II. 103, 2." and *C. peruviana* based on "Feuillée Diarium Bot. II. 319." As the latter is the same as *Lacerta caudiverbera* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: p. 200) it becomes the genotype.

Genus IX: GEKKO, p. 43 [err. typ.: 34]

Of the three species included in this genus *Gekko verticillatus* (p. 44) is only another name for Linnaeus' previous *Lacerta gecko* (Syst. Nat., 10 ed., vol. 1, 1758: 205) which therefore is the type of the genus by tautonymy.

Genus X: CHAMAELEO, p. 45

Laurenti is the first author to establish the genus *Chamaeleo,* except for Gronovius' *Chamaeleon* (1753, Zoophyl.: 12) which has been made unavailable by Opinion 89 of the International Commission on Zoological Nomenclature.

In his *Chamaeleo* Laurenti includes six named species, of which five appear to be based on figures in the first volume of Seba's *Thesaurus,* and one on a specimen in the Museum Turrianum, viz.:

p. 45. *Chamaeleo mexicanus,* based on Seba I. 82. 1.
Chamaeleo parisiensium, on Seba I. 82. 2 & 4 & 5.
p. 46. *Chamaeleo zeylanicus,* on Seba I. 82. 3.
Chamaeleo africanus, on Seba I. 43. 4 (generally accepted as a misprint for 83. 4).
Chamaeleo candidus, on specimen "in Museo Turriano."
Chamaeleo bonae spei, on Seba I. 83. 5.

One of the species represented by one of these names must be the type of the genus *Chamaeleo* of Laurenti.

The first step in determining the type according to Article 30 of the International Code of Zoological Nomenclature is to ascertain whether the case is one of type acceptation solely upon the basis of the original publica-

tion. As neither original type designation, nor monotypy is involved, there remains to be determined whether the genus "contains among its original species one possessing the generic name as its specific name, either as a valid name or synonym," in which case "that species or subspecies becomes *ipso facto* type of the genus."

Since the name *chamaeleo* does not occur as the trivial name of any of Laurenti's species, the question arises whether one of them "possesses" that name as a synonym, to answer which it becomes necessary to examine into the status of his species.

The species of which Laurenti has examined a specimen and which he called *C. candidus* is so poorly characterized that it must for ever remain unidentified. The few authors who have attempted to do so have guessed that it was a bleached specimen of the common chameleon, but nobody has proposed to use the name and it may safely be left out of consideration here.

All the others of the Laurentian names are based on Seba's figures on plates 82 and 83 of his first volume. Unfortunately they are so poor, that their identification is mostly very uncertain and the various interpreters have disagreed in most instances.

In studying Seba's figures with a view to their identification with the known species of chameleons, we must not expect to make such positive determinations as would compel us to substitute Laurenti's specific names for later ones which are based on incontrovertible evidence. The original specimens from which the engravings were made undoubtedly belong to the genus *Chamaeleo* as generally restricted, and it will be satisfactory if we can point out one of them as fairly representing the Linnaean species *Lacerta chamaeleo* in such a way that the Laurentian species may be said to "possess" the Linnaean name as a synonym. Fortunately, Seba's plate 82, figs. 2 (adult) and 4, 5 (young), the basis of *Chamaeleo parisiensium* Laurenti, fill that requirement. The figures represent a typical chameleon with a raised but not very high casque, no enlarged tubercles on the body; no dorsal crest; slightly enlarged granules on the median line of the throat; no ventral crest; no tarsal spur. As Linnaeus specifically quotes these figures under his *Lacerta chamaeleon,* I have no hesitation in declaring that *C. parisiensium* is the genotype of *Chamaeleo* Laurenti by tautonymy. The name of the common chameleon, therefore, becomes *Chamaeleo chamaeleon* (Linnaeus) by tautonymy. It can have but little weight that Boulenger (Cat. Liz. Brit. Mus., vol. 2: 443) in the synonymy of *C. vulgaris* quotes *C. parisiensium* with a query. All previous authors have unhesitatingly accepted the above identification.

Genus XI: Iguana, p. 47

Ten species. Type by tautonymy *Lacerta iguana* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 206), which equals *Iguana tuberculata* Laurenti, genotype.

Genus XII: Basiliscus, p. 50

Basiliscus americanus (p. 50) is the only species included, hence becomes genotype by monotypy, as well as by tautonymy as it is synonymous with *Lacerta basiliscus* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 206).

Genus XIII: DRACO, p. 50

Laurenti includes two species in this Linnaean genus (Syst. Nat., 10 ed., vol. 1, 1758: 199), *D. major* and *D. minor* both considered as belonging to the same species and synonymous with *Draco volans* Linnaeus, the genotype.

Genus XIV: CORDYLUS, p. 51

Gronovius (Zoophyl., 1763: 13) had already made *Lacerta cordylus* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 202) the monotype and tautotype of the genus *Cordylus*, but the name is unavailable by the action of the International Commission of Zoological Nomenclature (Opinion 89).

Laurenti reintroduced the name but included four more species. However, as his *Cordylus verus* (p. 52) is a synonym of *Lacerta cordylus* of Linnaeus, this species remains the genotype of *Cordylus* by tautonymy.

Merrem's monotypic *Zonurus* (Nat. Syst. Amph., 1820: 57) thus becomes a synonym, and the proper name of his *Zonurus cordylus* is *Cordylus cordylus* (Linnaeus).

Genus XV: CROCODYLUS, p. 53

The genotype is *Crocodylus "niloticus* = *Lacerta crocodilus* Linné in part," by subsequent designation of Stejneger and Barbour (Check List of North American Amphibians and Reptiles, 1 ed., 1917: 41).

For a full discussion of the question see the article on "Crocodilian Nomenclature" by Stejneger in COPEIA (No. 3, October 15, 1933: 117–120).

Genus XVI: SCINCUS, p. 55

Genotype by tautonymy *Scincus officinalis* which is Linnaeus' *Lacerta scincus* (Syst. Nat., 10 ed., vol. 1, 1758: 205; 12 ed., vol. 1, 1766: 365).

Genus XVII: STELLIO, p. 56

Stellio saxatilis Laurenti (p. 57) was designated by Stejneger in 1933 as the genotype. The designation was made in a letter to Malcolm A. Smith (published in the Journal of the Bombay Natural History Society, vol. 35, No. 3: 618–619), which was an abstract from the present manuscript. It is here given with a few slight modifications caused by Dr. Smith's annotations.

Laurenti's *Stellio*, the first application of this name to various genera of lizards, includes 8 nominal species, none of which can be accepted as type "solely upon the basis of the original publication" (Intern. Code, art. 30, I, a–d). As none of the 8 species are excluded from consideration in determining the type (same art., II, e) and as nobody apparently has selected as yet a type for Laurenti's *Stellio* (in contradistinction to *Stellio* Schneider, 1792, or *Stellio* Latreille, 1802) it seems that I am at liberty to designate the type (same art., g). None of the Recommendations of the Code, appended to Art. 30, has any direct bearing on the peculiarities of this case.

The 8 species named by Laurenti were all unknown to him except from Seba's figures and descriptions. Of these there is no difficulty in identifying *Stellio saurus*, *S. salvator* and *S. salveguardia* as belonging to the genus *Varanus*, and *S. thalassinus* has also been referred to it by Malcolm Smith. Authors likewise agree that Laurenti's *Stellio punctatus* is a skink, viz., Linnaeus' *Lacerta punctata* (= *Eumeces punctatus* of Duméril and Bibron = *Lygosoma punctatum* of Boulenger).

If Laurenti's *Stellio* were to be restricted to any of these species it would

supplant either *Varanus* or *Eumeces* or *Lygosoma* respectively, as *Stellio* is the older name, a calamity to be prevented if possible.

There remain 3 species, however, the identification of which is more or less doubtful, viz.:

1. *Stellio saxatilis* (Seba, II, 79. 4).
2. *Stellio tessellatus* (Seba, I, 76. 2) "Habitat in Virginia."
3. *Stellio viridis* (Seba, I, 75. 2) "Habitat in Virginia."

The first one Merrem (Syst. Amph. 1820: 52) renamed *Agama tetradactyla* because distinguished by having 4 toes on forefeet. The fourtoed *Stellio* or *Agama* has remained a mystery ever since and may be considered unidentifiable. The second and third he considered identical and renamed the compound *Lacerta longicauda.*

No one has recognized the *Agama* or the *Lacerta* since. An inspection of Seba's figures shows that Merrem's guesses were not fortunate. In the first place, Nos. 2 and 3 can not well belong to the same genus, as the former has small head scales and a serrated upper edge to the tail, and the latter has large head shields and no serrated upper tail edge. The former may be some iguanoid, while the latter shows a certain resemblance to *Tupinambis teguixin.*

Under these circumstances, rather than to cause a wholesale mixup of names current for a century, it seems the better policy to select as the type one of the unidentifiable names, a procedure calculated to lay the specter of *Stellio* becoming active again in herpetological nomenclature. With this in view I designate *Stellio saxatilis* Laurenti the type of *Stellio* Laurenti.

Genus XVIII: SEPS, p. 58

In this genus Laurenti included 17 species, of which seven were based on specimens observed by himself, the others mostly on Seba's figures. All of those examined by himself belong to the genus *Lacerta* as now commonly accepted, and many of the others, in so far as they can be identified, to such teiid genera as *Ameiva* and *Cnemidophorus.*

None of the species included possess *Seps* as a specific name or among their synonyms, and as far as I have been able to ascertain, nobody has designated a type for Laurenti's *Seps.*

The generic term *Seps* has been variously applied by subsequent writers, beginning with Daudin (1803) to lygosomid groups having *Lacerta seps* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 204) for type, a species unknown to, or at least not included by Laurenti. The result has been that the name *Seps* has become a source of confusion which can only be avoided by herewith designating Laurenti's *Seps caerulescens* (Syn. Rept., 1768: 62, pl. 1, fig. 3) as the type of his genus *Seps.* As this is a synonym of Linnaeus' *Lacerta agilis,* the type of *Lacerta* Linnaeus, the name *Seps* is effectually submerged.

Genus XIX: CHALCIDES, p. 64

Contains two species: "*Chalcides tridactyla* Columnae. Ecphras. 36" and "*Chalcides pinnata.* Seba II. 58. 7. & 8." The former is Linnaeus' *Lacerta chalcides* (Syst. Nat., 10 ed., vol. 1, 1758: 209) and is consequently the genotype by tautonymy.

Genus XX: CAECILIA, p. 65

This is a Linnaean genus (Syst. Nat., 10 ed., vol. 1, 1758: 229) which has for type Linnaeus' *C. tentaculata* in part. The designation was made in 1843 by Fitzinger (Syst. Rept.: 34) who mentions *C. lumbricoidea* Daudin as the type, but this species is one of the components of Linnaeus' original *C. tentaculata.*

Genus XXI: AMPHISBAENA, p. 65

Another Linnaean genus (Syst. Nat., 10 ed., vol. 1, 1758: 229) with genotype *Amphisbaena fuliginosa* Linnaeus (*loc. cit.*) designated by Fleming (Philos. Zool., vol. 2, 1822: 29), and by Fitzinger (Syst. Rept., 1843: 22).

Genus XXII: ANGUIS, p. 67

The status of this genus is identical with that of the last two established by Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 227), type by designation of Fleming (Philos. Zool., vol. 2, 1822: 289), and by Fitzinger (Syst. Rept., 1843: 23), *Anguis fragilis* Linnaeus.

Genus XXIII: NATRIX, p. 73

Of the 22 species included by Laurenti in this genus, his *Natrix vulgaris* (p. 75) is the genotype both by tautonymy (*Coluber natrix* Linnaeus, Syst. Nat., 10 ed., vol. 1, 1758: 220) and by subsequent designation (Fleming, Philos. Zool., vol. 2, 1822: 29).

Genus XXIV: CERASTES, p. 81

Under this generic term Laurenti described no less than 11 species, none of which includes the name *Cerastes* as a specific name; none is named specifically *typicus* or *typus;* nor is any of the included species doubtfully referred to it or treated as a *species inquirenda.* Finally, as far as I have been able to ascertain, no subsequent author has as yet designated a genotype of *Cerastes* Laurenti 1768. It is therefore my pleasure to designate Laurenti's *Cerastes candidus* as the type, thus making it a synonym of *Naja* Laurenti 1768: 90 (type by tautonymy *Coluber naia* Linnaeus) as *Cerastes candidus* is properly identified with the previously named *Coluber haje* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 225). By this action the generic name *Cerastes* which had caused much trouble in herpetological nomenclature is practically eliminated. The designation of any other of the 11 Laurentian species would have replaced some well established generic name as will be seen from the following enumeration:

C. severus is the designated type of *Xenodon* Fitzinger 1826
C. plicatilis is the designated type of *Pseudoeryx* Fitzinger 1826
C. aurora is the designated type of *Lamprophis* Fitzinger 1843
C. rhombeatus is the designated type of *Psammophylax* Fitzinger 1843
C. agilis is the designated type of *Erythrolamprus* Wagler (Fitzinger 1843)
C. lacteus is the designated type of *Elaps* Fleming 1822
C. nebulatus is the designated type of *Sibon* Fitzinger 1843
C. cobella is the designated type of *Liophis* Wagler (Fitzinger 1843)
C. coronatus is the monotype of *Spilotes* Wagler 1830
C. mexicanus belongs in *Spilotes* Wagler 1830
C. candidus belongs in *Naja* Laurenti 1768

Genus XXV: CORONELLA, p. 84

The first definite designation of a type for Laurenti's *Coronella* seems to have been made by Cope in 1860 (Proc. Acad. Nat. Sci. Philadelphia, 1860:

245) who selected *Coronella austriaca* (p. 84) and whose choice has been generally accepted.

Genus XXVI: Boa, p. 88

Linnaeus in 1758 (Syst. Nat. 10 ed., vol. 1: 214) established the genus *Boa* which among others included the species *Boa constrictor* Linnaeus. Laurenti in 1768 by creating the genus *Constrictor* (p. 106) and including in it a species having *Boa constrictor* as a synonym, made the latter the genotype of his genus *Constrictor,* while at the same time retaining the generic term *Boa* for the three nominal species *B. thalassina, B. aurantiaca* and *B. exigua,* all three of which are synonyms of Linnaeus' *Boa canina* (Syst. Nat., 10 ed., vol. 1, 1758: 215) which thus virtually becomes the monotypic genotype of the restricted genus *Boa* in conformity with Opinion 5 of the International Commission of Zoological Nomenclature (1910: 7).

Genus XXVII: Dipsas, p. 89

The genotype is *Dipsas indica* Laurenti (p. 90) which is the only species included.

Genus XXVIII: Naja, p. 90

Genotype by tautonymy and practically also by monotypy, as all the 6 nominal species included by Laurenti are synonyms of *Coluber naja* Linnaeus (Syst. Nat., 10 ed., vol. 1, 1758: 221).

Genus XXIX: Caudisona, p. 92

Fleming, in 1822 (Philos. Zool., vol. 2: 294) designated as type *C. horridus* which corresponds to Laurenti's *Caudisona durissus,* based on Catesby's pl. 41. The latter is not Linnaeus' *Crotalus durissus.*

Genus XXX: Coluber, p. 94

The genus was established in 1758 (Syst. Nat., 10 ed., vol. 1: 216) by Linnaeus and *Coluber constrictor* Linnaeus was designated by Fitzinger in 1843 (Syst. Rept.: 26) as the type.

Genus XXXI: Vipera, p. 99

Fleming, in 1822 (Philos. Zool., vol. 2: 295) designated *V. berus* as the type of the genus *Vipera,* but as this species was not included by Laurenti the designation is void. As a matter of fact, Laurenti had included *berus* in the genus *Coluber.* On the other hand, Fitzinger, in 1843, designated *Vipera redii* as the type. This being Laurenti's *Vipera francisci redi* which equals *Coluber aspis* Linnaeus, the latter becomes the genotype of *Vipera.*

Genus XXXII: Cobra, p. 103

Laurenti's genus embraces three nominal species, viz., *C. clotho, C. lachesis* and *C. atropos.* The two former are based on figures by Seba (Seba II. 93 and 94. 2) and are practically unidentifiable. Moreover, by most authors they have been considered probable synonyms of the third species, Linnaeus' *Coluber atropos.* This view makes the latter type by monotypy. But, in addition, Fitzinger in 1826 (Neue Classif. Rept.: 33) established *Cobra* for Daudin's *Vipera atropos,* which thus becomes type of the genus by subsequent designation.

Cobra is consequently the proper name for the genus commonly known as *Bitis.*

Genus XXXIII: ASPIS, p. 105

The question of the genotype of this species has been discussed by me on a previous occasion (Medd. Zool. Mus. Kristiania, No. 2, 1922: 7). I still hold that "the type of *Aspis*, according to the interpretation of the International Rules, Art. 30, I, d, by the International Commission on Zoological Nomenclature, as expressed in their Opinion 16, is clearly *Aspis cleopatrae*. Laurenti in quoting Lucanus' *Aspis* as applying to the species *Aspis cleopatrae* has fixed the latter as the type by tautonymy, whether interpreting Lucanus correctly or incorrectly."

Genus XXXIV: CONSTRICTOR, p. 106

The genus comprises 5 nominal species, three of which, viz., *C. formosissimus, C. rex serpentum* and *C. auspex,* all based on Seba's figures, are considered conspecific and synonymous with Linnaeus' *Boa constrictor* (Syst. Nat., 10 ed., vol. 1: 215) which thus becomes the genotype by tautonymy.

Genus XXXV: LATICAUDA, p. 109

Of the two nominal species included, *L. scutata* is a synonym of Linnaeus' previous *Coluber laticaudatus* (Syst. Nat. 10 ed., vol. 1, 1758: 222). This is practically tautonymy, but to make doubly sure I designated *L. scutata* (Herpet. Japan: 402) in 1907, as the type of *Laticauda.*

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Description of a New *Phyllodactylus* from Mexico, with Remarks on the Status of *P. tuberculosus*

By WALTER MOSAUER

IN the course of an herpetological expedition[1] to Mexico, in 1935, the writer secured two specimens of an apparently undescribed gecko of the genus *Phyllodactylus.* Both specimens were collected among large boulders in the tropical forest near Tierra Colorada, Guerrero. They differ strikingly from the local population of *Phyllodactylus tuberculosus* which is common in the some locality.

Phyllodactylus ***delcampi***[2], sp. n.

TYPE SPECIMEN.—No. 41238, M.C.Z.; collected at Tierra Colorada, Guerrero, August, 1935, by W. Mosauer.

PARATYPE.—No. 42139, M.C.Z. Same data.

DIAGNOSIS.—A large *Phyllodactylus,* with 12 to 13 dorsal longitudinal

[1] I wish to express my sincere gratitude to the authorities of the University of California for the financial support, in the form of a research grant, of the expedition during which the material discussed was collected, and to the Mexican authorities for the many courtesies extended throughout the course of the expedition. I am also deeply indebted to Dr. Edward H. Taylor of the University of Kansas for information and the loan of literature, such as a transcript of Wiegmann's paper, to Mr. Joseph R. Slevin of the California Academy of Sciences, to Mr. L. M. Klauber of the Zoological Society of San Diego, to Dr. Doris Cochran of the U.S. National Museum, and to Dr. F. S. Wood of the Los Angeles Junior College, for the loan of specimens of *P. tuberculosus.*

[2] Named for Señor Rafael Martin del Campo, director of the Natural History Museum of Mexico, whose researches are contributing much to our knowledge of the herpetology of his native country. He has also very kindly aided visiting colleagues in the pursuit of their studies.

rows of enlarged, keeled tubercles, which are very much smaller than in *P. tuberculosus* from the same locality; no enlarged tubercles present on occipital and temporal region, nor on the dorsal surface of the extremities; color a purplish brown, with irregular dark brown cross bands; head, legs, and sides reticulated and mottled.

DESCRIPTION.—Head and body not greatly compressed; temporal regions swollen; head covered with small scales which are largest in the frontal region, especially in the anterior interorbital region (in the paratype); occipital region covered with small, regular granular scales, without interspersed larger tubercles. Semi-circular shelf of scales over eye, weaker than in *P. tuberculosus;* ear opening small, narrow, oblique; rostral almost twice as broad as high, with a median groove in its posterior part, followed by a pair of internasals which form a sharply depressed median suture; seven upper labials to below the center of the eye, the scales behind that point very small; a large mental, somewhat broader than the rostral, bell-shaped, adjoining the first lower labial in a concave border; two large, polygonal postmentals, completely separated from each other by the produced point of the mental (in the paratype, the postmentals meet in a short median suture) postmentals followed by a row of enlarged scales (5 in type; 6 in paratype); a pair of small scales interposed on either side between this row and the lower labials; in the type, the median one of the enlarged scales meets the point of the mental, separating completely the two postmentals; 6 lower labials to a point below the center of the eye; gulars considerably smaller than ventrals; granules on dorsal surface of neck minute, with interspersed small tubercles; scales on back very small, granular, with twelve longitudinal rows of enlarged, slightly keeled tubercles which are very much smaller than in *P. tuberculosus;* tubercles considerably less than 1 mm. in length; 11–12 tubercles to one centimeter length along a row; dorsal surface of thigh covered with minute granules, anterior surface with medium sized, smooth, imbricating scales; dorsal surface of tibia covered with somewhat irregular scales, none of which appear as prominent tubercles; ventral surface of tibia covered with smooth, imbricating scales of medium size; 12 to 13 lamellae under fourth toe, excluding the terminal pad (14 and 16 in the paratype); the latter divided, triangular in shape, spatulate, with a straight distal edge and barely rounded corners; scales of fore limb regular, without enlarged tubercles; 12 lamellae under fourth finger; lamellae immediately following terminal pad divided on toes and fingers; ventral scales smooth, imbricating, in about 66 transverse rows from shoulder to anus, and in 29–30 longitudinal rows; tail regenerated in both specimens.

The dorsal ground color is a purplish brown, with five to seven dark brown cross bands on neck and body; the dorsal surface of the head and of the extremities is reticulated with the same color. The central surface is uniformly and rather darkly suffused with brown, in contrast to the almost pure white ventral coloration of *P. tuberculosus.* The bands are narrower in the middorsal line, wider towards the sides. Seven bands are present in the paratype from the neck to the sacrum; in the type, several of the bands have become confluent, reducing the lighter ground color between them to middorsal, transversely elliptical spots.

Fig. 1. *Phyllodactylus delcampi*, sp.n. Type. Dorsal view. On the head, the fore limb, and zone A, scutellation and pattern are represented, on zone B and the hind limb, complete scutellation only is indicated.

Fig. 2. *P. delcampi*, ventral view of head. Fig. 3. Same, lateral view of head.

Fig. 4. Enlarged right half of part of zone A, fig. 1.

Fig. 5. Right front foot, dorsal view. Fig. 6. Same, ventral view.

Measurements:

	Snout to vent	Tail	Snout to ear	Width of head	Length of forelimb	Length of hind limb
Type	82	Regenerated	23	16.5	29	38
Paratype	86	Regenerated	24.5	17	30	41

Remarks: It was believed possible that the specimens here described belong to the species *P. mentalis* which was described by Franz Werner (1910) from one specimen in the Zoologische Museum at Hamburg. Dr. Paul de Grijs of that museum was kind enough to compare the type specimen, catalogue no. 3421, with description and photographs of my specimens, and to furnish me with a good deal of information some of which is here presented in translation: "The type of *mentalis* is without locality record, a poorly preserved specimen; apparently it died in captivity and was greatly emaciated. In general habitus it is very much like *P. tuberculosus*. Head and body 40 mm. long (50 mm. in Werner's original description). The shape of the mental is the same as in *P. tuberculosus*, but the postmentals are somewhat larger and form a longer median suture. The dorsal tubercles are arranged in twelve more or less longitudinal rows; they are flatter and larger than in *P. tuberculosus* of the same size. Keeled tubercular scales on the dorsal surface of the extremities are missing in the type of *mentalis*, and are present on the head only on the posterior part of the occiput."

My specimens apparently agree with the type of *mentalis* in the number of dorsal tubercular rows, and in the absence of tubercles from the dorsal surface of the extremities. The very small size of the dorsal tubercles in *P. delcampi*, however, remains as a distinctive characteristic, as well as the purplish brown color with cross bands. Dr. de Grijs appears to doubt somewhat the validity of *P. mentalis*, while the specific difference of *delcampi* from *tuberculosus* is obvious at first glance. Since *mentalis* was described from an ill-preserved specimen without locality record, it seems preferable to describe the present specimens under a different name, rather than to place them in a poorly known species.

Remarks on the Status of *Phyllodactylus tuberculosus*

Throughout the description of *P. delcampi*, reference has been made to specimens of *P. tuberculosus* from the same locality (Tierra Colorada, Guerrero). Hobart Smith (1935) has recently described specimens from that locality and from other points in Guerrero and one locality in Sinaloa, under the name of *P. lanei*. His type is from Tierra Colorada. I am not adopting his nomenclature for the following reasons:

P. tuberculosus was described by Wiegmann in 1835, and the name has since become well established and has been commonly used to designate specimens from a wide range of localities in the western hemisphere, including locality records from the Pacific coast of the United States. Only very good and substantial reasons could justify the substitution of a new name for so well-established and descriptive a term as *P. tuberculosus*.

Smith (*loc. cit.*: 120) refuses to accept Wiegmann's type locality "Californien," as referring to Baja California or to the state of California, as it has been heretofore generally assumed. He states that "there are a number of important facts which show that this interpretation cannot be correct," for one thing, the expedition which made the collection in which these specimens

were contained did not touch California, according to the ship's log book. Consequently, Smith concludes, "It would seem almost beyond doubt that 'Californien' must refer to some small village near one of the ports Meyen is known to have visited." It seems to the present author that the evidence is not entirely conclusive since proof for the existence of a village of that name is not presented. "Californien" is the usual, and still widely used, Germanization of California, and the latter name is supposed to be unique. Many theories have been advanced concerning its origin; the name itself has no known meaning, and only names with a definite meaning (e.g. *Tierra Colorada,* Red Earth) are used often in widely distant points. Besides, the Germanized ending in "Californien" shows that the term refers to a territory, not to a single locality—individual place names are not altered in German usage, but are retained in the original form. As explanation of the discrepancy between expedition itinerary and locality record, it might be suggested that the specimens could have been purchased, preserved in a bottle, from a sailor, or that Wiegmann could have included specimens from another collection in his report.

Generally speaking, it is dangerous to refute without sufficient evidence statements made by older authors. In the same paper, Smith (1935) quotes Werner (1910) concerning the locality of *P. mentalis*: "Aus dem Nachlasse von L. v. Pöppinghausen, also wahrscheinlich Zentralamerika, speziell Mexico." Smith continues: "Burt and Burt (1933) state that the range is 'probably South America'—a logical supposition, as most of the American specimens described by Werner in this paper came from South America." The logic is not quite evident to me, since Werner was probably well informed about Pöppinghausen's range of collecting, and had more first hand information than his reviewers about the collections on which he worked.

Let us now consider Smith's second point of evidence (*loc. cit.*: 121): "Moreover, the original description of *P. tuberculosus* differs widely from the characteristics of specimens available from the United States, and Mexico, including Baja California. It has appeared from the study of this material, that the name *tuberculosus* must be applied to the South American and possibly also to the Galapagos Islands form . . . " It would have to be shown that Wiegmann's original description and figure apply better to South American specimens, and that these are specifically distinct from the specimens of Mexico, Baja California, and Southern California, before describing the latter as new species. Smith has not furnished any evidence concerning specific differences of his *P. lanei* and specimens of *P. tuberculosus* from South America and the Galapagos Islands. He states differences only between his actual specimens of what he calls *P. lanei,* and Wiegmann's description and figure of *P. tuberculosus,* but not between actual specimens from Mexico and from South America.

The differences thus obtained are the following (*loc. cit.*: 130): first, the shape of the terminal adhesive pad on fingers and toes is considered and a difference is noted. Secondly, Smith quotes Wiegmann's description of the lepidosis of the tail—the enlarged tubercles on the tail are "in undeutliche Quergürtel gestellt; an reproducirten Schwänzen erscheinen sie sehr ungleich, dicht anliegend, glatt and geschindelt." This description applies perfectly

well to specimens of *P. tuberculosus* from Tierra Colorada. Equally correct is Wiegmann's description of the postmentals and the transverse row of 4–5 smaller scales following them—all my specimens from Tierra Colorada show this row of enlarged scales, although Smith (p. 130) states: "Only the first-mentioned shield (the postmental) exists in *P. lanei* and *P. homolepidurus*." Furthermore, Smith finds the dorsal tubercles in Wiegmann's illustration too large—but whoever has seen a representative series of *P. tuberculosus* has noticed the great variability in the size of these tubercles.

I have taken opportunity to examine specimens of *P. tuberculosus* from a wide range of localities, including several in South America, numerous islands in the Gulf of California, Baja California, and the desert part of southern California (from the splendid collections of Mr. Klauber, and of the California Academy of Sciences). I have been unable to find any constant differences between the specimens from these widely scattered localities. The *P. tuberculosus* in my collection from Tierra Colorada are absolutely indistinguishable from specimens from other localities, indicating that *P. lanei* Smith should be placed in the synonymy of *P. tuberculosus* Wiegmann. There exists a wide range in the size and shape of the dorsal tubercles, in the number, size, and acuteness of the conical tubercles on the dorsal surface of the extremities, and in the size and number of enlarged scales following the postmentals. Some specimens from the islands of the Gulf of California show as large and as prominent tubercles as those on Wiegmann's figure.

I am not in a position to judge the validity of *P. homolepidurus*, described by Smith simultaneously with *P. lanei*. Some specimens in Mr. Klauber's collection, from the desert area of southeastern California, show characters approaching closely those ascribed by Smith to *homolepidurus* (very weakly keeled, flat dorsal tubercles, light dorsal color, etc.). Whether these characters are sufficient to justify specific separation from *P. tuberculosus* is an open question, in view of the great variability of the latter.

Summary

1. A new species of gecko from Mexico has been described, *Phyllodactylus delcampi*.

2. *Phyllodactylus lanei* Smith is considered invalid and placed in the synonymy of *P. tuberculosus* Wiegmann. Specimens from islands of the Gulf of California, from Lower California, and from Southern California also belong to the latter species.

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Variations in the Number of Vertebrae of the Sardine, *Sardinops caerulea* (Girard)[1]

By Frances N. Clark

MUCH work has been done on the differences in the number of vertebrae in the adult sardine along the Pacific coast of North America (Hubbs, 1925, and Hart, 1933a and 1933b). In addition to these summations, there are available a few more data on the vertebral numbers of adult sardines, and many counts of vertebrae of young fish. The purpose of this paper is to bring together and compare all the vertebral counts for adult fish, to present the preliminary findings for young sardines, and to suggest further lines of work.

The study should contribute further data applicable to the questions: Do the sardines from different localities along the Pacific coast of North America mingle freely, or are the fish in certain localities confined to those regions only? If mingling does occur, what proportion of the adult population is derived from each of the several nursery grounds? These problems are being attacked along several fronts by the Pacific Biological Station at Nanaimo and by the California State Fisheries Laboratory at Terminal Island. A knowledge of the variations in number of vertebrae should help to explain facts learned from all these studies.

Fig. 1. Map showing geographical variation in number of vertebrae in *Sardinops caerulea*.

In general for fishes, the numbers of vertebrae and other meristic characters increase in colder waters. Since decrease in temperature is associated with increase in latitude, sardines from northern waters, off British Columbia for example, should have a higher average number of vertebrae than do those found in Californian or Mexican waters, provided the populations do not mix. If mingling does occur, a condition indicated by all investigations made to date, the relationship between the numbers of vertebrae from sardines of

[1] Printed with the permission of the California Division of Fish and Game. Paper prepared for the meeting of the Western Division of the American Society of Ichthyologists and Herpetologists, at Seattle, June, 1936.

different localities may prove to be very complex. Such a complexity appears in the vertebral counts here presented.

The vertebral frequencies, the averages, and the standard errors of the averages, for all counts which have been made on both young and adult fish are shown in the accompanying table. Adult fish comprise sardines larger than 170 or 180 mm., standard length. Young fish are sardines of smaller size; for the counts here presented, very few young fish exceeding 150 mm. in standard length were used. The counts for Alaska, based on 24 adult sardines, were made by Dr. G. A. Rounsefell and forwarded to the California State Fisheries Laboratory. The data for British Columbia fish are taken from Hart (1933a, 1933b) with a few additional data gathered by the staff of the California State Fisheries Laboratory. The counts of adult sardines from California are from Hubbs (1925), supplemented by counts made by Hart on Monterey fish and by additional data gathered by the California State Fisheries Laboratory. Most of the counts for the young fish were made by the writer, but a few data by other staff members of the Laboratory and by Hubbs are also included. All counts are adjusted to include the hypural.

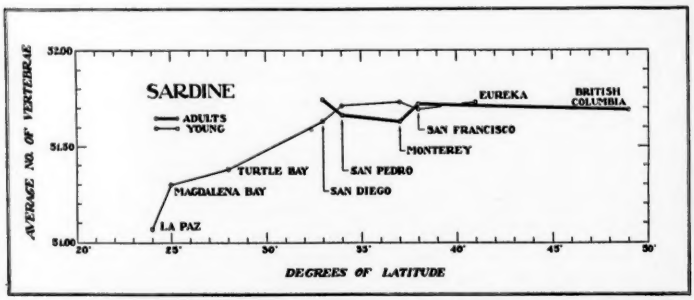

Fig. 2. Graph showing relation between number of vertebrae and latitude in *Sardinops caerulea*.

Figure 1 shows the average vertebral numbers at different localities for young and for adults. Figure 2 suggests the relationship between average vertebrae and latitude. Both figures and the table indicate that the average numbers of vertebrae for adult sardines from all localities between Alaska and San Diego differ but little. For 11 of the 15 possible comparisons, the differences are less than twice their respective standard errors. Of the 4 remaining comparisons, the differences between the averages for the Monterey and San Francisco samples and between those for the San Pedro and San Diego series are twice their standard errors, and those between the Monterey and British Columbia collections and between those from Monterey and San Diego are 3 times the standard errors. These 4 differences may be considered statistically significant, but the irregular manner of their occurrence suggests complex biological causes. An analysis of variance based on the method developed by R. A. Fisher indicates that the chances of the adult sardine population being homogeneous along the entire Pacific coast

are less than 1 in 100. The present data, consisting of vertebral counts of 12,858 adult sardines, indicate, therefore, a complex adult population along the Pacific coast of North America. The average number of vertebrae for all adults is 51.672.

TABLE I. NUMBER OF VERTEBRAE BY LOCALITY FOR ADULT AND YOUNG SARDINES

Age and Locality	No. of Fish	Number of Vertebrae						Average	Standard Error of Average
		49	50	51	52	53	54		
ADULTS:									
Alaska	24	..	..	13	10	1	..	51.500	0.118
British Columbia	8993	2	118	3130	5243	497	3	51.681	0.006
San Francisco	336	..	5	121	175	33	2	51.720	0.037
Monterey	2179	2	38	837	1197	105	..	51.626	0.013
San Pedro	987	..	16	361	554	55	1	51.660	0.019
San Diego	339	..	..	107	212	20	..	51.743	0.030
All adults	12858	4	177	4569	7391	711	6	51.672	0.005
YOUNG:									
California:									
Eureka	421	..	3	133	258	27	..	51.734	0.028
Tomales Bay	300	..	..	108	179	13	..	51.683	0.032
San Francisco	589	..	6	201	350	32	..	51.693	0.024
Monterey	993	1	17	312	579	84	..	51.733	0.020
San Pedro	1291	1	12	425	770	82	1	51.715	0.017
San Diego	1132	3	31	408	629	60	1	51.632	0.019
Mexico:									
Turtle Bay	119	..	6	64	47	2	..	51.378	0.056
Magdalena Bay	300	..	22	173	99	6	..	51.297	0.036
La Paz	211	1	26	143	39	2	..	51.072	0.041
All California young	4726	5	69	1587	2765	298	2	51.696	0.009
All Mexican young	630	1	54	380	185	10	..	51.237	0.025
All young	5356	6	123	1967	2950	308	2	51.642	0.009

For young sardines, counts are available for fish from California and Mexican waters. The vertebral number for young fish from Mexican waters differs appreciably from that for California sardines. There are 36 possible comparisons. Between the average values for any 2 localities in California no differences are as great as twice their standard errors, excepting the difference between the values for the San Diego and Eureka samples, and between the Monterey and San Pedro series. These exceptional differences exceed their standard errors by 3 times. An analysis of variance shows the chances to be less than 1 in 100 that all the California young fish came from the same population.

The young from California have a vertebral count very similar to that for the adults from California and northward. The variations between localities are not as great, however, for California young as for all adults. The average for all California young, based on counts from 4,726 sardines, is 15.696, a value which is slightly (0.023) in excess of the average for all adults. This difference, though small, is slightly more than twice its standard error and may eventually prove to be significant biologically as well as statistically.

For young fish from Mexican waters, the differences between the averages for various localities off Mexico and off California all exceed their standard errors by 4 or more times, and are significant statistically and presumably also biologically. Furthermore, the differences between the average numbers

of vertebrae of sardines taken off the west coast of Lower California and from near La Paz in the Gulf are also significant. The much warmer waters of the Gulf of California furnish a ready explanation for this difference. The average vertebrae for all young fish from Mexican waters, based on 630 individuals, is 51.237. This is 0.436 of a vertebra less than the average for all adults and 0.459 of a vertebra less than for all California young. These differences are more than 17 times their standard errors.

These data on vertebral counts indicate that the adult fish off California and British Columbia comprise a complex population. The lack of clear cut differences between many localities suggests that these complexities may be brought about by intermingling of sardines from different regions. Irregularities in the vertebral averages of various samples from a single locality further substantiate this suggestion. The California and British Columbia adults may be derived from young reared in California waters, or other nursery grounds may also contribute to the California and British Columbia populations. But little is known of the presence or absence of young sardines north of California and nothing of the vertebral characteristics of such fish. Investigations are needed, therefore, to determine whether enough young fish are reared north of California to produce the adult population of the northern waters and to ascertain if such young have the same vertebral counts as do the adults. Further work is necessary on young sardines from California waters to eliminate the influence of vertebral differences between individual year-classes and to explain the complexities of the population of young California fish. Also, vertebral counts should be made from additional collections of young fish from Mexico, and studies of the southern adults should be included. These studies would be used to determine if adult and young Mexican sardines together comprise a distinct population, or if older fish intermingle with populations from the north.

The work in California is being continued by the State Fisheries Laboratory. Whenever opportunity offers, collections are secured and studied from Mexican waters. But help is needed to obtain information about young sardines north of California. If one or more workers in Oregon, Washington and British Columbia would attempt a study of young fish from these regions, the sardine investigation would be materially aided. Studies of adult fish from Washington and Oregon would also be advantageous. If such studies cannot be made, any collections forwarded to the California State Fisheries Laboratory would contribute greatly to the analysis of the sardine populations of the Pacific coast of North America.

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California State Fisheries Laboratory, Terminal Island, California.

A Revision of the Genus *Icelinus* Jordan

By Rolf L. Bolin

THE cottid genus *Icelinus* contains 8 species of fishes: *Icelinus quadriseriatus, I. borealis, I. fimbriatus, I. oculatus, I. burchami, I. filamentosus, I. tenuis,* and *I. cavifrons.* Of these the last 3 have long been considered as constituting the separate genus *Tarandichthys,* "distinguished by the presence of filamentous dorsal spines, and the presence of bony plates behind the axil." *Tarandichthys* is, however, but 1 of 4 fairly comparable aggregations of species into which the group may be subdivided, and to which it seems advisable to accord subgeneric rather than generic rank. The genus in the broad sense of 8 species constitutes a moderately compact systematic unit, very well differentiated from, and similar in importance to its nearest relatives, *Icelus, Chitonotus, Artedius, Radulinus* and *Stlengis.*

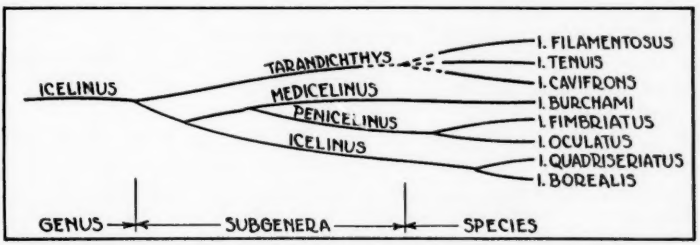

Fig. 1. Diagram of the interrelationships of the fishes of the genus *Icelinus.*

My reasoning is that the characters which have been used for the differentiation of *Tarandichthys* from *Icelinus* are so variable as to be of doubtful generic significance. The 2 anterior spines of the 1st dorsal which are much elongated in *I. filamentosus* are represented in *I. tenuis* by a very long 1st spine and a 2nd spine which is exceedingly variable in length, sometimes being but little produced. In a young specimen of *I. tenuis,* 28 mm. in standard length, the tendency toward elongation of these spines is hardly expressed at all, while in *I. cavifrons* it is only the males which have filamentous dorsal spines. This variable character, which according to the meager data available is not expressed in juvenile specimens at all and which is expressed by only 1 sex in 1 of the 3 species, seems to be of less than generic importance.

In addition, *Tarandichthys* is distinguished by having scales behind the axilla, but the number of scales is very variable, not only in the different species, but between individuals of the same species and on different sides of the same individual. In *Icelinus cavifrons* it is not rare to find the number of scales reduced to 1 and from this it is a short step to complete absence. While these 2 characters do serve to divide the 8 fishes into two groups, it seems better to consider them as the expression of the first evolutionary split of the ancestral generic stock into minor groups than to accord them generic value.

The various degrees of morphological similarity between the species and possibly the course of evolution is indicated in the figure. The 3 species constituting the subgenus *Tarandichthys,* which was separated from the remaining line by the evolutionary split just noted, seem each to be about equally removed from the others. In considering their relationships we are forced to weigh the value of conflicting evidence presented by several variable characters. Any 2 species could be grouped together by according importance to 1 character, but other characters lead to different conclusions and no 2 characters substantiate each other. It seems best, therefore, to consider the mutual interrelationships of these species as approximately equal.

The species of the other main line of descent fall into natural groups. Shortly after the splitting off of *Tarandichthys,* the remaining stem apparently divided into two branches. One of these seems to have developed along a line similar to *Tarandichthys,* except for the fin and scale differences already noted; the anterior pores of the mandibular series opening in a common pit on the symphysis, the pelvic fins remaining of normal size, and the dorsal spines remaining devoid of cirri. This branch, the subgenus *Icelinus,* split rather late into the 2 most closely related species of the genus, *Icelinus quadriseriatus* and *I. borealis.*

The other branch, characterized by having the anterior mandibular pores separate, by pelvic fins much reduced in size, and by cirri on the tips of the dorsal spines, soon split once more into 2 lines of development which may be termed subgenera. The subgenus *Penicelinus,* retaining a long dorsal band of scales similar to that of *Icelinus* and developing the genital papilla of the male into a very large and prominent penis, split in turn into the 2 well differentiated species *Icelinus oculatus* and *I. fimbriatus.* The other subgenus, *Medicelinus,* characterized by the posterior reduction of the dorsal scale band so that the dorsal surface of the caudal peduncle is naked as in *Tarandichthys,* and by the normal structure of the genital papilla, evidently remained stable and has given rise to the single species *Icelinus burchami.*

Generic Description.—Body deepest somewhere under anterior half of first dorsal, widest at base of pectorals, neither markedly compressed nor depressed. Dorsal and ventral contours forming almost straight lines from vertical of anus to slender caudal peduncle. Width of head equal to or greater than greatest depth of body. Lower jaw slightly shorter than upper, somewhat included; maxillary extending to somewhere under eye. Anterior nostrils in short tubes, their median posterior borders produced as triangular flaps; posterior nostrils with slightly elevated margins. Interorbital space narrow, its width not greater than posterior width of maxillary. Four preopercular spines; the upper one long, antler-like, with a simple or bifid point and 1 to 5 strong, recurved barbs along its upper margin; below this 3 short, sharp, simple spines, covered and obscured by skin, becoming progressively stronger from upper to lower, which is slightly larger than recurved barbs of antler-like spine. The upper of these simple spines directed backward, the middle one backward and downward and the lower one downward and forward. Many small pores scattered over the dorsal and lateral

surfaces of head; those following the main branches of the lateral line system large and well defined. Gill-membranes united, free from isthmus. Branchiostegals, 6.

Origin of first dorsal approximately over upper end of gill-opening, the first 2 spines with approximated bases, the others evenly spaced. Second dorsal contiguous to the 1st dorsal or separated from it by a very narrow interspace. The middle rays of 2nd dorsal subequal and longest; 1st and last rays abruptly shorter than adjacent rays; contour of fin evenly rounded except posteriorly where the height decreases abruptly; membrane connecting last ray to caudal peduncle very short, involving extreme base of ray only. Origin of anal under or slightly posterior to origin of second dorsal; its posterior end somewhat in advance of posterior end of second dorsal; middle rays subequal and longest; contour like that of second dorsal. Pectorals with broad procurrent bases and broadly rounded contours; extending to somewhere between anus and 4th anal ray. Origin of pelvics slightly behind lower end of pectoral base; bases of fins close together; fin composed of 1 concealed spine and 2 rays, the inner one the longer. Caudal truncate or slightly rounded.

A varying number of cirri on head and body; always a well developed, flattened, supraorbital cirrus, and 1 or more cirri on maxillary near its posterior end, the latter sometimes very small and inconspicuous. Lateral line arched abruptly over opercular flap, armed with 35 to 43 scales embedded in the skin but presenting free margins posteriorly. These scales, best developed anteriorly, are in the form of short tubes, with upper and lower posterior angles expanded in the form of flattened plates, the posterior margin irregularly and variably ctenoid. Posteriorly they become simpler and more elongate. A band of scales, 2 scales in width, extending along the back a short distance below the base of dorsal fins, the upper series presenting free margins posteriorly and ventrally, the lower series presenting free margins posteriorly and dorsally. These scales are in the form of 2 intersecting planes; the free edge of the outer plane possesses a strongly ctenoid margin.

Moderately wide bands of recurved, cardiform teeth on premaxillaries, dentaries, vomer and palatines; patches of similar teeth on pharyngeals. No slit behind fourth gill.

ARTIFICIAL KEY TO THE KNOWN SPECIES OF *ICELINUS*

a. Dorsal band of scales not extending beyond posterior end of 2nd dorsal.

b. Two distinct spines at upper posterior angle of orbit.

c. Top of head marked by an abrupt depression; 2nd dorsal

cc. Top of head gently concave; second dorsal of 17 to 18 rays.....2. *tenuis*

bb. No distinct spines at upper posterior angle of orbit.

d. First 2 dorsal spines much produced; a few small scales behind axilla; pelvic fins extending about 1/3 distance to origin of anal .....1. *filamentosus*

dd. None of dorsal spines produced; no scales behind axilla; pelvic fins extending 1/5 or 1/6 distance to origin of anal.....4. *burchami*

aa. Dorsal band of scales continued on dorsal surface of caudal peduncle.

e. Ventral fins small, extending less than 1/3 distance to anal origin; 2 anterior pores of mandibular series opening separately on either side of symphysis.

f. A single cirrus near posterior margin of maxillary.....6. *oculatus*

ff. A fringe of cirri along posterior margin of maxillary.....5. *fimbriatus*

ee. Ventral fins moderate, extending more than 1/3 distance to anal origin; 2 anterior pores of mandibular series opening together in a common pit on symphysis.

g. Dorsal scale band having its origin under 4th or 5th dorsal spine; no cirrus at base of nasal spine.....7. *quadriseriatus*

gg. Dorsal scale band having its origin under 1st or 2nd dorsal spine; a cirrus at base of nasal spine.....8. *borealis*

Subgenus *Tarandichthys* Jordan and Evermann

TYPE.—*Icelinus filamentosus* Gilbert.

Anterior pores of mandibular series opening into a common pit on symphysis; first 1 or 2 dorsal spines filamentous, at least in adult males; pelvic fins of normal size; no cirri developed on dorsal spines; dorsal scale band not extending beyond base of 2nd dorsal; one or more embedded ctenoid scales behind axilla; genital papilla of males not enlarged.

1. *Icelinus filamentosus* Gilbert

Icelinus filamentosus Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 50, 84, 85; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356; Gilbert, Rept. U. S. Comm. Fish., 19, 1893 (1895): 469.

Tarandichthys filamentosus Jordan and Evermann, in Jordan, Proc. Calif. Acad. Sci., (2) 6, 1896: 225, pl. 28; Jordan and Evermann, Rept. U. S. Comm. Fish., 21, 1895 (1896): 436; Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1891, 1892; Gilbert and Thompson, Proc. U. S. Nat. Mus., 28, 1905: 976; Starks and Morris, Univ. Calif. Publ. Zool., 3, 1907: 218; Evermann and Goldsborough, Bull. U. S. Bur. Fish., 26, 1906 (1907): 223, 297; Starks, Ann. Carn. Mus., 7, 1911: 210; Gilbert, Proc. U. S. Nat. Mus., 48, 1915: 339; Kincaid, An annotated list of Puget Sound fishes, 1919: 30; Ulrey and Greeley, Bull. South. Calif. Acad. Sci., 27, 1928: 14; Hubbs, Journ. Pan-Pac. Res. Inst., 3 (3), 1928: 13; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

Tarandichthys filamentosis Ulrey, Journ. Pan-Pac. Res. Inst., 4 (4), 1929: 9.

DIAGNOSIS.—No spines at upper posterior angle of orbit nor on posttemporal; a very short spine at lower angle of subopercle. D. X–XI, 15–17; A. 13–15; P. 17–18. First 2 dorsal spines filamentous. Pelvics extending about 1/3 distance to anal origin. Nasal cirrus present. Lateral line armed with 38 to 39 scales; dorsal scale band extending from 3rd or 4th dorsal spine to end of 2nd dorsal; 2 to 6 scales behind axilla.

Reexamination of 3 of Gilbert's original specimens in the Stanford University collections reveals that all have 38 scales in the lateral line instead of 36 to 37 as stated in the type description. I have never found less than 38 scales in any of the 42 specimens counted.

DISTRIBUTION.—From the Gulf of Georgia (Albatross Sta. 4193) to off Point Loma, California (Albatross Sta. 4310), in from 18 to 204 fathoms. It should be noted that the record given by Jordan, Evermann and Clark (1930) as "Alaska, off St. Mary's Mission" is an error. It is based on a too literal acceptance of the title of Evermann and Goldsborough's paper *The Fishes of Alaska*. The locality, St. Mary's Mission, is more than 400 miles from the Alaskan border.

2. *Icelinus tenuis* Gilbert

Icelinus tenuis Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 50, 84, 86, 88; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356; Gilbert, Rept. U. S. Comm. Fish., 19, 1893 (1895): 468.

Tarandichthys tenuis Jordan and Evermann, Rept. U. S. Comm. Fish., 21, 1895 (1896): 436; Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1891, 1893; Gilbert, Rept. U. S. Comm. Fish., 24, 1898 (1899): 26, 29; Starks and Morris, Univ. Calif. Publ. Zool., 3, 1907: 218; Evermann and Goldsborough, Bull. U. S. Bur. Fish., 26, 1906 (1907): 223, 297; Gilbert, Proc. U. S. Nat. Mus., 48, 1915: 339; Ulrey and Greeley, Bull. South. Calif. Acad. Sci., 27, 1928: 14; Hubbs, Journ. Pan-Pac. Res. Inst., 3 (3), 1928: 13; Ulrey, *ibidem*, 4 (4), 1929: 9; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

DIAGNOSIS.—Two sharp spines at upper posterior angle of orbit; a small spine on posttemporal; no spinous point on subopercle. D. IX–X, 16–19; A. 13–17; P. 16. First dorsal spine, and sometimes 2nd, much produced. Pelvics extending about ⅓ distance to origin of anal fin. No cirrus at base of nasal spine and none on eyeball. Lateral line armed with 40 to 43 scales; dorsal band of scales extending from 4th, 5th or 6th dorsal spine to somewhere between 6th and 11th dorsal ray; 5 to 15 scales behind axilla.

The statement by Evermann and Goldsborough (1907) that the first 2 scales of the lateral line are enlarged and that the 1st scale has a distinct spine is a misleading error. What they considered to be the first scale was undoubtedly the posttemporal and they evidently mistook the dorsal portion of the supracleithrum for an enlarged 2nd scale.

DISTRIBUTION.—From Queen Charlotte Sound (Albatross Sta. 4204) to off Point Loma, California (Albatross Sta. 4309), in from 18 to 204 fathoms. In Jordan, Evermann and Clark (1930), we find the same error in recording an Alaskan distribution for this species as was made in the case of *Icelinus filamentosus*.

3. *Icelinus cavifrons* Gilbert

Icelinus cavifrons Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 50, 83, 84; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356.

Tarandichthys cavifrons Jordan and Evermann, Rept. U. S. Comm. Fish., 21, 1895 (1896): 436; Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1891; Starks and Morris, Univ. Calif. Publ. Zool., 3, 1907: 218; Starks and Mann, *ibidem*, 8, 1911: 15; Gilbert, Proc. U. S. Nat. Mus., 48, 1915: 339; Fowler, Proc. Acad. Nat. Sci. Phila., 75, 1923: 299; Ulrey and Greeley, Bull. South. Calif.

Acad. Sci., 27, 1928: 14; Ulrey, Journ. Pan-Pac. Res. Inst., 4 (4), 1929: 9; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 375.

DIAGNOSIS.—Nape marked by an abrupt pit. Two sharp spines at upper posterior angle of orbit; a small spine on posttemporal; a short sharp spinous point at lower angle of subopercle. D. IX–X, 13–15; A. 12–13; P. 14–16. First 1 or 2 dorsal spines of male much produced. Pelvics extending about half way to a point midway between anus and anal origin. No nasal cirrus; 1 or more small cirri on eyeball. Lateral line armed with 37 to 39 scales; dorsal band of scales extending from 5th or 6th dorsal spine to somewhere between 11th and 14th dorsal ray; 1 to 4 scales behind axilla.

DISTRIBUTION.—*Icelinus cavifrons* is the most southern representative of the genus. I have examined 3 specimens from Monterey Bay, California, 36° 36′ 30″ N. Lat., 121° 53′ 00″ W. Long., and one from Santa Maria Bay, Lower California. These records extend the previously known range about 150 miles to the north and 500 miles to the south. *I. cavifrons* is found in depths of from 6 to 50 fathoms.

Medicelinus, new subgenus

TYPE.—*Icelinus burchami* Evermann and Goldsborough.

Anterior pores of mandibular series opening separately on either side of symphysis; none of dorsal spines produced; pelvic fins very small; cirri developed on tips of dorsal spines; dorsal scale band not extending beyond end of 2nd dorsal; no scales behind axilla; genital papilla not enlarged.

Medicelinus, a contraction of *medius,* mid, plus *Icelinus;* in reference to its intermediate position in regard to scale reduction.

4. *Icelinus burchami* Evermann and Goldsborough

Icelinus burchami Evermann and Goldsborough, Bull. U. S. Bur. Fish., 26, 1906 (1907): 221, 223, 297, fig. 48; Hubbs, Journ. Pan-Pac. Res. Inst., 3 (3), 1928: 14; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

Icelinus fuscescens Gilbert, Proc. U. S. Nat. Mus., 48, 1915: 305, 340, fig. 9; Ulrey and Greeley, Bull. South. Calif. Acad. Sci., 27, 1928: 12; Ulrey, Journ. Pan-Pac. Res. Inst., 4 (4), 1929: 9; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

DIAGNOSIS.—No spines at upper posterior angle of orbit; nor on posttemporal, nor on subopercle. Pores of head very large. D. IX–X, 16–18; A. 12–14; P. 18–19. Pelvics extending $\frac{1}{5}$ to $\frac{1}{6}$ distance to anal origin. No nasal cirrus. Lateral line armed with 35 to 39 scales; dorsal band of scales extending from 5th, 6th or 7th dorsal spine to next to last dorsal ray.

DISTRIBUTION.—From Behm Canal, off Loring, Alaska (Albatross Sta. 4228), to off San Nicholas Island, California (Albatross Sta. 4421), in depths of from 134 to 238 fathoms.

Penicelinus, new subgenus

TYPE.—*Icelinus fimbriatus* Gilbert.

Anterior pores of mandibular series opening separately on either side of

the symphysis; none of the dorsal spines produced; pelvic fins very small, cirri developed on tips of dorsal spines; dorsal scale band continued on dorsal surface of caudal peduncle; no scales behind axilla; genital papilla of male developed into a large prominent penis.

Penicelinus, from *penis* and *Icelinus.*

5. *Icelinus fimbriatus* Gilbert

Icelinus fimbriatus Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 50, 85, 87; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356; Jordan and Evermann, Rept. U. S. Comm. Fish., 21, 1895 (1896): 436; Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1894; Starks and Morris, Univ. Calif. Publ. Zool., 3, 1907: 218; Ulrey and Greeley, Bull. South. Calif. Acad. Sci., 27, 1928: 8; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

DIAGNOSIS.—Two low, blunt, recumbent spines at upper posterior angle of orbit; no spines on posttemporal; a small sharp spinous point at lower angle of subopercle. D. X, 15–16; A. 12–13; P. 16–18. Pelvics small, about 3.5 in distance from pelvic base to anal origin. Nasal cirrus large, with an expanded palmate tip; 1 to 4 well developed cirri on eyeball. A fringe of cirri on posterior end of maxillary. Lateral line armed with 36 to 38 scales; dorsal band of scales having its origin under the 3rd or 4th dorsal spine.

DISTRIBUTION.—This species has previously been known only from the Santa Barbara Channel, the southernmost record being from Albatross Station 2975, off Santa Cruz Island. The northern range is here extended about 150 miles to Monterey Bay on the basis of three specimens from 36° 38′ 23″ N. Lat., 121° 53′ 30″ W. Long., and 1 specimen from 36° 38′ 05″ N. Lat., 121° 53′ 00″ W. Long. The bathymetric range is from 33 to 145 fathoms.

6. *Icelinus oculatus* Gilbert

Icelinus oculatus Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 50, 85, 87; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356; Gilbert, Rept. U. S. Comm. Fish., 19, 1893 (1895): 415, 416; Jordan and Evermann, *ibidem,* 21, 1895 (1896): 436; Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1894, 1895, 1896; Ulrey, Journ. Pan-Pac. Res. Inst., 4 (4), 1929: 9; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

DIAGNOSIS.—Spines at upper posterior angle of orbit small or absent; no spine on posttemporal; a small spinous point at lower angle of subopercle. D. X, 16–17; A. 13–14; P. 17. Pelvics extending about ¾ distance to a point midway between anus and anal origin. Nasal cirrus present. A single cirrus on end of maxillary. Lateral line armed with 38 to 40 scales; dorsal scale band extending from 2nd or 3rd dorsal spine to beyond end of 2nd dorsal. No scales behind axilla.

DISTRIBUTION.— The type of this species, from Albatross Station 2935, off Ocean Beach, California, appears to be the only specimen recorded in the literature. There are 2 additional specimens in the collections of Stanford University, 1 from southern California and the other from Albatross

Sta. 3080, off the coast of central Oregon. The latter specimen extends the known range about 1250 miles. The species has been taken at depths ranging from 93 to 124 fathoms.

Subgenus *Icelinus* Jordan

TYPE.—*Artedius quadriseriatus* Lockington.

Anterior pores of mandibular series opening into a common pit on the symphysis; none of the dorsal spines produced; pelvic fins of normal size; no cirri developed on dorsal spines; dorsal scale band continued on dorsal surface of caudal peduncle; no scales behind axilla; genital papilla of males not enlarged.

7. *Icelinus quadriseriatus* (Lockington)

Artedius quadriseriatus Lockington, Proc. U. S. Nat. Mus., 2, 1879 (1880): 330; Rept. Calif. Comm. Fish., 1878–1879 (1880): 26; Jordan and Gilbert, Proc. U. S. Nat. Mus., 3, 1880 (1881): 25; *ibidem:* 454; Jordan and Jouy, *ibidem,* 4, 1881 (1882): 6; Jordan and Gilbert, *ibidem:* 61; *ibidem,* 5, 1882 (1883): 578; Goode and associates, The fisheries and fishery industries of the United States, Sec. 1, 1884: 259; Jordan, *ibidem,* Sec. 2, 1887: 612.

Icelus quadriseriatus Jordan and Gilbert, Bull. U. S. Nat. Mus., 16, 1882: 691.

Icelinus quadriseriatus Jordan, Rept. U. S. Comm. Fish., 13, 1885 (1887): 898; Eigenmann and Eigenmann, West Amer. Sci., 6, 1889: 131; Gilbert, Proc. U. S. Nat. Mus., 13, 1890 (1891): 85; Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., 6, 1892: 356; Smith, Bull. U. S. Fish Comm., 14, 1894 (1895): 288; Gilbert, Rept. U. S. Comm. Fish., 19, 1893 (1895): 468; Jordan and Evermann, *ibidem,* 21, 1895 (1896): 436; Jordan, Proc. Calif. Acad. Sci., (2) 6, 1896: 225, pl. 29; Jordan and Evermann, Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1894, 1897, 1919; Gilbert, Rept. U. S. Comm. Fish., 24, 1898 (1899): 26, 29; Starks and Morris, Univ. Calif. Publ. Zool., 3, 1907: 219; Starks and Mann, *ibidem,* 8, 1911: 15; Gilbert, Proc. U. S. Nat. Mus., 48, 1915: 339; Osburn and Nichols, Bull. Amer. Mus. Nat. Hist., 35, 1916: 174; Fowler, Proc. Acad. Nat. Sci. Phila., 75, 1923: 291, 299; Ulrey and Greeley, Bull. South. Calif. Acad. Sci., 27, 1928: 12; Ulrey, Journ. Pan-Pac. Res. Inst., 4 (4), 1929: 9, Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

DIAGNOSIS.—No spines at upper posterior angle of orbit; none on posttemporal; a small spinous point at lower angle of subopercle. D. VIII–X, 13–15; A. 11–13; P. 16. Pelvics 2.1 to 2.4 in distance from pelvic base to anal origin. No cirrus at base of nasal spine. Lateral line armed with 35 to 37 scales; dorsal band of scales extending from 4th or 5th dorsal spine to near end of 2nd dorsal where it is usually interrupted for a short space and then continued as a single series on each side of the dorsal surface of the caudal peduncle.

DISTRIBUTION.—From Albatross Sta. 3176, off Point Reyes, California, to Port San Bartholome, Lower California, in from 10 to 55 fathoms.

8. *Icelinus borealis* Gilbert

Icelinus borealis Gilbert, Rept. U. S. Comm. Fish., 19, 1893 (1895): 394, 415, 475, pl. 25; Jordan and Evermann, *ibidem*, 21, 1895 (1896): 436; Starks, Proc. Calif. Acad. Sci., (2) 6, 1896: 552; Jordan and Evermann, Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1894, 1896, 1898; Jordan and Gilbert, Fur Seals and Fur Seal Islands, pt. 3, 1899: 454; Jordan and Evermann, Bull. U. S. Nat. Mus., 47, pt. 4, 1900: fig. 688; Gilbert and Thompson, Proc. U. S. Nat. Mus., 28, 1905: 976; Evermann and Goldsborough, Bull. U. S. Bur. Fish., 26, 1906 (1907): 223, 298, fig. 49; Starks, Ann. Carn. Mus., 7, 1911: 188, 210; Gilbert and Burke, Bull. U. S. Bur. Fish., 30, 1910 (1912): 36; Kincaid, An annotated list of Puget Sound fishes, 1919: 30, fig. 65; Hubbs, Journ. Pan-Pac. Res. Inst., 3 (3), 1928: 13; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376; Soldatov and Lindberg, Bull. Pac. Sci. Fish. Inst., 5, 1930: 171; Andriashev, Invest. Seas U. S. S. R., No. 22, 1935: 142, 144.

Icelinus strabo Starks, Proc. Calif. Acad. Sci., (2) 6, 1896: 549, 551; Jordan and Evermann, Bull. U. S. Nat. Mus., 47, pt. 2, 1898: 1894, 1897; *ibidem*, pt. 3, 1898: 2862; Halkett, Check list of fishes of the Dominion of Canada and Newfoundland, 1913: 99; Jordan, Evermann and Clark, Rept. U. S. Comm. Fish., 1928, pt. 2 (1930): 376.

Icelinus microps Starks, Proc. Calif. Acad. Sci., (2) 6, 1896: 552.

DIAGNOSIS.—No spines at upper posterior of orbit; none on posttemporal; a small spinous point at lower angle of subopercle. D. IX–X, 15–17; A. 12–14; P. 15–17. A long slender cirrus at base of nasal spine; pelvics 2.0 to 2.7 in distance from pelvic base to anal origin. Lateral line armed with 37 to 40 scales; dorsal band of scales originating under first or second dorsal spine, extending without interruption on the dorsal surface of the caudal peduncle.

DISTRIBUTION.—This species ranges from the vicinity of Attu Island at the end of the Aleutian chain (Albatross Sta. 4784) to the Straits of Juan de Fuca and Puget Sound. It occurs in depths of 11 to 135 fathoms.

NOTE.—In addition to the species noted above, a form called *Icelinus australis* was very inadequately described by Eigenmann and Eigenmann (West Amer. Sci., 6, 1889: 131) from 2 small half-digested specimens taken from the stomach of a "rock cod" caught on Cortez Banks. I have examined the type, U. S. N. M. 31917, and find it to be in such a hopeless condition that I doubt if it can ever be satisfactorily identified. It is probable that the specimen does not belong to the genus *Icelinus*, and it may be ignored when considering this group.

HOPKINS MARINE STATION, PACIFIC GROVE, CALIFORNIA.

A New Species of *Cyprinodon* from Lake Eustis, Florida

By A. F. Carr, Jr.

During the past 4 years, I have frequently seen a peculiar sheepshead minnow in the shallow water along the maiden cane beaches of Lake Eustis, Lake County, Florida. At the suggestion of Dr. Carl L. Hubbs, Curator of Fishes, University of Michigan Museum of Zoology, I am describing it as a new form. It is named in his honor.

Although apparently closely allied to the subspecies of *C. variegatus*, the several unique characters of this form, and the fact that it is isolated in a body of freshwater whose connection with the Atlantic is 200 miles in length, led me to believe that it should be accorded specific rank.

Cyprinodon ***hubbsi,*** new species

Diagnosis.—A very small *Cyprinodon*, with generally reduced pigmentation; body more nearly cylindrical and interorbital width much less than in *C. variegatus;* length of adult males 20 to 27 mm., of adult females, 23 to 31 mm.; depth in length, 3.6 to 4.4; width in depth, 1.2 to 1.6; snout in eye, 1.0 to 1.7; interorbital width into length, 12 to 19; eye in head, 2.3 to 3.2; eye in caudal peduncle, 1.1 to 1.8; head in length, 2.9 to 4.0; dorsal rays 11; anal rays 11; scales 25 or 26 to caudal base.

Coloration (preserved material): Sides pale white with 7 or 8 brown or grayish brown vertical bars, and also a small irregular brown spot in each interspace in the female; back with numerous black pigment spots, most numerous along the mid-dorsal line and between the ends of the lateral bars; top of head between and slightly back of eyes blackish; cheeks and upper and lower jaws white, with scattered brown pigment spots; operculum transparent, with brown of gills showing through, and with accentuation of brown pigmentation of cheeks; eyes black; lower surface white, with viscera showing black through body wall.

Holotype, an adult male 26 mm. long.—Head, 8 mm.; depth in length, 3.8; eye in head, 2.5; eye in caudal peduncle, 1.2; scales 25; dorsal rays 11; anal rays 11. Coloration in life: Sides pale silvery white with 8 broad vertical bars of gray, the last 4 or 5 roughly Y-shaped; the bars of the two sides meeting on the mid-dorsal line; spaces between the bars with scattered black pigment spots and an iridescent, greenish blue sheen; belly white; breast and pectoral fins very dilute orange; dorsal surface light gray, crossed by the continuations of the lateral dark bars and with a metallic green iridescence between; iridescence accentuated on top of head and upper half of pupil of eye; lower half of pupil, cheeks and chin white; caudal fin with a vertical black bar about 2 mm. from body; space between this bar and body white; rays with tiny black pigment spots; membranes colorless; dorsal with spots of gray and black pigment on rays of its upper half.

Allotype, an adult female 30 mm. long.—Head, 9 mm.; depth in length, 3.4; eye in caudal peduncle, 1.7; eye in head, 3.1; scales 25; dorsal rays 11; anal rays 11. Coloration in life: Sides with 8 roughly Y-shaped vertical bars of dark olive, not meeting dorsally; spaces between pearly white with green iridescence; dorsal surface with 9 wide transverse bands of dark olive, which run together anteriorly, but are separated posteriorly by greenish-

white interspaces; sides of belly, breast and bases of pectoral fins washed with dilute orange; belly, breast, and chin pearly white; venter back of anal with closely spaced white, V-shaped markings, with apices directed cephalad; top of head dark green; ventrals and lower third of anal bright, iridescent green; anterior portion of dorsal with numerous black pigment spots; posterior half colorless, with a large black spot occupying middle portions of rays 6 to 11 and their membranes; caudal as in male.

Fig. 1. *Cyprinodon hubbsi,* female paratype. Enlarged.

Cyprinodon hubbsi approaches *variegatus* from the East Coast of Florida in coloration, but differs strongly in the much less elevated contour at the origin of the dorsal fin. Although similar in size to the dwarfed lake form, *C. baconi,* described from Andros by Breder,[1] and the West Indian *dearborni, hubbsi* has very different body proportions and much narrower interorbital.

In addition to showing marked differences in coloration and slight differences in certain other characters, examples of *C. variegatus* from the Gulf coast of Florida tend to show a greater enlargement of the humeral scale and more scale rows on the belly than specimens from the east coast of Florida. In these respects *hubbsi* agrees more closely with the Gulf form. Differences in proportions are indicated in Table 1.

C. hubbsi apparently cannot be allocated in the subspecies gradient, *ovinus, variegatus* and *artifrons,* mentioned by Hubbs in his description of *C. v. artifrons.*[2]

This minnow has been seen only along the east and west shores of Lake Eustis. Here the relatively strong wave action has created extensive sandy beaches, but has been insufficient to hinder the growth of a moderate stand of maiden cane (*Panicum hemitomum*), which extends into the water for a distance of from about 30 to 100 feet. Stunted cypress trees and sparse growths of submerged vegetation (*Myriophyllum, Chara* and *Hypericum*) are also found.

Commonly taken in the same seine-hauls with *C. hubbsi* are *Chaenobryttus gulosus* (Cuvier and Valenciennes), young of *Helioperca macrochira* (Rafinesque), *Lepomis auritus* (Linnaeus), *Menidia beryllina atrimentis* Kendall, *Notropis roseus* (Jordan), *Opsopoeodus emiliae* Hay, young of

[1] Breder, C. M., Jr. An annotated list of fishes from Lake Forsythe, Andros Island, Bahamas, with description of three new forms. *Am. Mus. Nov.,* No. 551, 1932: 1, fig. 1.

[2] Hubbs, Carl L. Fishes of the Yucatan Peninsula. *Carn. Inst. Wash. Publ.* 457, 1936: 223, pl. 6. figs. 1–5.

TABLE 1 FREQUENCY TABLE SHOWING PROPORTIONS IN 3 FORMS OF *Cyprinodon*

Standard length ÷ depth of body

	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	N
C. hubbsi	..	..	..	..	..	..	..	..	..	..	..	..	..	6	2	5	4	5	4	7	2	3	38
C. variegatus, E. Florida	2	1	3	1	2	..	..	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	13
C. variegatus, W. Florida	1	3	5	8	10	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30

Standard length ÷ length of head

	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	N
C. hubbsi	..	1	1	6	5	6	7	5	4	1	1	..	1	38
C. variegatus, E. Florida	1	..	1	1	2	4	1	2	1	..	..	..	..	13
C. variegatus, W. Florida	..	..	1	..	2	2	4	14	4	3	..	..	..	30

Standard length ÷ interorbital width

	8	9	10	11	12	13	14	15	16	17	18	19	N
C. hubbsi	..	..	..	..	1	2	9	7	9	6	2	2	38
C. variegatus, E. Florida	1	5	7	..	..	..	..	..	..	..	..	..	13
C. variegatus, W. Florida	1	12	13	4	..	..	..	..	..	..	..	..	30

Length of eye ÷ length of snout

	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	N
C. hubbsi	..	..	7	9	5	3	9	4	..	1	38
C. variegatus, E. Florida	2	4	5	2	..	..	..	..	..	..	13
C. variegatus, W. Florida	..	..	14	12	2	2	..	..	..	..	30

Depth of body ÷ width of body

	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	N
C. hubbsi	14	6	7	10	1	..	..	..	..	..	..	..	38
C. variegatus, E. Florida	..	..	..	..	..	3	2	2	1	1	2	2	13
C. variegatus, W. Florida	..	..	..	..	..	1	3	10	8	6	1	1	30

Ameiurus natalis (Le Sueur), *Fundulus seminolis* Girard and *Strongylura marina* (Walbaum). The principal invertebrate inhabitants of this sandy, littoral zone are Zygoptera and Anisoptera nymphs, burrowing may-fly nymphs, caddis-fly larvae, and the larvae of the "blind mosquito," *Chironomus* sp.

Lake Eustis is about 6 miles long and 4 miles across. It drains, via Lake Harris, Lake Griffin, Oklawaha River and Saint Johns River, into the Atlantic at Jacksonville.

Although extensive seining has been done in similar situations in several neighboring lakes, including Lake Harris, *C. hubbsi* has not been taken outside Lake Eustis.

Specimens examined, 94, as follows: holotype, allotype, and 30 paratypes from southwest shore of Lake Eustis, May 5, 1934; 62 paratypes from east shore Lake Eustis, February 17, 1934, and April 15, 1936; all collected by A. F. Carr, Jr., and T. D. Carr. Holotype, allotype and 46 paratypes in the Museum of Zoology, University of Michigan; 46 paratypes in the collection of the Department of Biology, University of Florida.

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Ichthyological Notes

OBSERVATIONS ON THE BREEDING OF THE LAWYER, *LOTA MACULOSA*.[1]—In view of the fact that little information is available on the breeding habits of the American burbot or "lawyer," *Lota maculosa* (LeSueur),[2] the writer welcomed an opportunity to study this question, which came his way during February, 1936, while he was located on Burntside Lake, near Ely, Minnesota. While these observations are fragmentary and very far from complete, due to the extreme weather conditions which prevailed during the spawning season and to the fact that the egg laying occurred just prior to the departure of the writer to other regions, nevertheless they may be of value as throwing some light on the habits of one of our common fishes, and as indicating a series of problems which seems to offer unusual interest.

One often thinks of the great northern pike, *Esox lucius*, as initiating the spawning season of our inland lake fishes, as this species deposits its eggs shortly after the ice goes out in the spring. As a matter of fact, the first species to spawn seems to be the lawyer, which, in northern Minnesota at least precedes the northern pike by about 3 months. The conditions under which it spawns are particularly interesting when compared with those associated with the spawning of various other species, in which external physical factors seem to play an important part.

Lota maculosa is a bottom form. The summer is spent in deep water, as indicated by the fact that the fish are frequently taken in commercial lake trout nests. With the obliteration of the thermocline in the fall, the fish seem to come up into somewhat shallower water, and are then taken at a depth of about 30 feet by fishermen who are in quest of the wall-eyed pike, while in winter they are often caught on hook and line at a depth of 20 feet. Only during the spawning period do they come into really shallow water. With the freezing of the lake in October or early November, the static conditions of the winter "rest" period prevail. In Burntside Lake the ice was 34 inches

[1] Published under a grant from the American Wildlife Institute for the publication of contributions fundamental to fish management.

[2] I find no thorough account of the breeding habits of the American species *Lota maculosa*, and only 1 reference (Levander, 1903) on the breeding habits of the European *Lota lota*. Minor notes on the spawning of the American burbot are given by Adams and Hankinson (1928: 517).

thick on February 6, the date on which the fish began to run. Under remarkably uniform conditions (observations show that neither oxygen, carbon dioxide nor temperature can play a part), the lawyer spawns. The following dates give the time of spawning for the last 6 years in Burntside Lake, Ely, Minnesota:

1931: February 14.	1933: February 18.	1935: February 7.
1932: February 10.	1934: February 5.	1936: February 6.

The average date of spawning for these years is February 10.

The spawning occurs in water from 1 to 3 or 4 feet in depth. At the breeding season the fish come into the shallow bays and spawn on sand or gravel bottom, under the ice. It is for this reason that the fish are seldom seen during the breeding season. It so happens that the outlet of Burntside Lake is a small river which leaves the lake at the tip of a gravel-bottomed bay, and tumbles over a short rapid to become a sluggish river. Here the current is sufficient to keep an area of about 20 yards square constantly free of ice, and here the spawning may be observed. That the current plays no part in the spawning activities is indicated by the fact that the fish are to be found in almost every bay having the proper bottom, and may be seen through holes cut in the ice. The current here simply affords an ideal area for easy observation.

Spawning is a nocturnal activity only. During the day the area in question proved entirely free of fish, though the fish that had inadvertently gone over the little falls at the outlet could be seen in the rapids below. As dusk approached, dozens and dozens of fish could be seen under the shelving ice edge, working back and forth just under the shelter of the ice ledge, and always on the bottom. In the rays of a flashlight, they showed themselves to be highly sensitive to light, and to be strongly negatively phototropic. The moment a beam hit a fish it became active and retreated to a dark shelter; the beam of a 3-celled pocket flash was ample to cause a precipitous retreat. Moonlight had only a mild effect on the fish, but it was noted that on nights when the moon was bright (full moon February 7), the fish came from under the shadow of the ice later than on nights that were very dark, and were less abundant in the observable area.

During the spawning period it would appear that very little food is consumed. Prior to this period (December, January), specimens examined were full of crayfish and minnows, but an examination of 37 specimens taken during the spawning activity, showed 36 with an empty digestive tract, and 1 specimen only containing one small, partially digested crayfish. There is no sex significance in this abstinence of food.

Approaching the open water area during the breeding period, a very marked "fishy" taint was noticeable in the air for a distance of more than a quarter of a mile. This was unmistakably that of the lawyer, despite the fact that there were no exposed fish anywhere. With the temperature standing at 36° below zero, even an exposed fish would hesitate to smell.

To and including February 6, when the temperature was —36° F., no fish had appeared in the shallows, and there was no noticeable fish odor in the air. On February 7 many lawyers were seen, and the fishy odor was noted for the first time, and was persistent from then on. Of the 19 fish then taken, all proved to be males. These could be "milked" with difficulty. The water temperature at a depth of 18 inches was 1.5° C., and it remained stationary at this figure. On February 8, at an air temperature of —12° F., many fish were seen and 12 were taken, again all males; again on February 9, at an air temperature —19° F., only males (12) were taken; on February 10 at an air temperature of —27° F., 9 males and 3 females were caught. Hence the indications are that the males precede the females to the spawning grounds. The females stripped with difficulty, and were evidently not quite ready to spawn. There was no evidence of any interest shown by one fish toward another.

On the night of February 12 the interesting phenomenon of breeding was observed. The air temperature was —28° F. with no wind, hence observations in the water were clear and distinct. At first a dark shadow was noted at the edge of the ice, something which appeared to be a large ball. Eventually this moved out into view and it was seen to be indeed a ball—a tangled, nearly globular mass of moving, writhing lawyers. The fish were all intertwined, slithering over one another constantly, slowly, weaving in and out of the living ball. About ten or a dozen fish were involved, but every effort to

capture the ball in its entirety proved futile, for the moment anything touched it, the ball instantly disintegrated, the individual fish dashing under the ice for protection. This ball was watched for 15 minutes before it was disturbed. Every fish in it was active, apparently, and the whole aggregation reminded me of a knot of earthworms taken out of a bait pail. As soon as a fish wriggled its way through the mass and got its head out into the open far enough, it turned to one side, worked its head back into the mass and slowly wormed its way through in another direction. The movements were not fast, yet they were deliberate and constant. There was no orientation of dorsal or ventral surfaces in their proper positions; the fish went in and out right side up, upside down, or on its side. The mass as a whole moved slowly here and there, aimlessly, depending on the activity of the fish, but remained in water about 4 feet deep. It was hard to judge the size of the ball, but it was probably about 30 inches in diameter. Finally the ball threatened to roll back under the ice and out of sight, so an effort was made to capture it with a dip-net. The result was 3 fish: 2 males and 1 female. This shows that the ball is composed of both sexes, and it is probably associated with the actual egg-laying and fertilization. It seems probable that the movement of the males over the bodies of the females is the stimulus which results in the extrusion of the eggs. The captured female was discharging eggs in a steady stream as she came out of the water, and the males were emitting sperm in milky clouds. The exact composition of these balls, in terms of males and females, could not be determined; it was too bitterly cold to handle equipment properly. From the fishermen who have taken lawyers for many years at this season of the year I learn that these balls are a regular, constant phenomenon of the lawyer's brief stay in the shallows. That more balls are not seen is probably due to that fact that there is so very little open water wherein observations can be made. This little 20 yard square is the only open water in all Burntside Lake, with its huge lawyer population spawning in all the gravel bays.

On February 13 many fish were seen, but only 1 was taken, a female which had not yet spawned. The ovaries were removed and weighed on a chemical balance, and it was found that they scaled 518.5 grams. In an effort to estimate the number of eggs they contained, a quantity of eggs totalling 0.5 gram was weighed out, and the component eggs were counted under a microscope. This 0.5 gram contained 1112 eggs, giving a total egg complement of 1,153,144. This female measured 27.5 inches in length, 12.5 inches in girth, and weighed 5.5 pounds. I would consider her to be an average Burntside Lake female. The clear eggs measure 1.25 mm. in diameter. There is a single rather large oil globule, as already noted by Prince and Halkett (1906).

It is interesting to note that the lawyer is a member of the family Gadidae, and is a fresh-water cod. It is especially interesting to note that its spawning period falls well within the time range of the spawning period of its salt-water relatives, and at a temperature very closely approaching the critical temperature for the spawning of those ocean forms. Examination fails to show that the spawning of the lawyer is associated with any change in oxygen, carbon dioxide, pH, temperature, weather conditions above the barrier ice layer, food supply, light conditions or penetration, or barometric pressure. Is it possible that *Lota* has maintained its inherent codfish breeding cycle all these many years? Are these spawning habits relics of the days when salt water covered the region and *Lota*—or its ancestor—was a salt water fish, retaining during all that time its original physiological breeding rhythm?

The writer appologizes for the fragmentary character of the observations, but since he probably will not have any opportunity to continue the study in the future, they are offered in the hope that someone else will take up the interesting problems presented.

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1906 The eggs of the freshwater ling. *Ottawa Naturalist*, 19: 219–224.

Alvin R. Cahn, *Tennessee Valley Authority, Knoxville, Tennessee.*

A SOUTHERN AND EASTERN RECORD OF TWO PACIFIC FLYING FISHES, *CYPSELURUS CALIFORNICUS* AND *ALTIPENNIS*.—A specimen of *Cypselurus californicus* (Cooper) of 388 mm. standard length, 495 mm. total, was taken 55 miles west of Masafuera Island on January 29, 1935, by Mr. Templeton Crocker on the cruise of his yacht "Zaca" in the eastern Pacific. The fish agrees admirably with the description in Jordan and Evermann[1] and with material in the American Museum of Natural History. This represents a considerable southward extension of the known range of this large flying fish and likely represents to some extent its migratory movement, since it is known to disappear from California waters regularly. There are also 3 specimens taken by Mr. Crocker in late November, 1935, from the west coast of Lower California (November 23 and 24; 27° 30′ N. Lat., 114° 52′ W. Long., and 30° 23′ N. Lat., 116° 19′ W. Long.). Two are males of 290 and 340 mm. standard length with well developed gonads, and one a female of 385 mm. with apparently recently spent ovaries. Nichols and Murphy[2] recorded a single specimen about one foot long washed ashore in a dying condition at Central Chincha Island, off Peru, on November 11, 1919. Mr. H. W. Major, a recent visitor to the west coast of South America, states that flying fish are not in much evidence, coastwise, south of Cape Blanco, northern Peru. Nichols and Breder[3] did not find this species in a rather large collection from the Galapagos Islands, nor have any of the rather numerous expeditions to those islands recorded it, although they are almost on a line from California to Masafuera.

A specimen of *Cypselurus altipennis* (Cuvier and Valenciennes), of 210 mm. standard length, flew aboard the ill-fated ship *Carnegie* on her last voyage, at Easter Island, February 27, 1929, at 7:00 P.M., and was sent us for study. It is now deposited in the American Museum, as Cat. No. 13580. This specimen establishes an easterly record for this form. We would refer the following names to its synonymy:

Exocoetus altipennis Cuvier and Valenciennes, Hist. Nat. Poiss., 19, 1846: 109, pl. 560 (Indian Ocean).
? Exocoetus speculiger Bleeker, Nat. Tijdschr. Ned. Indie, 9, 1855: 273 (not of Cuvier and Valenciennes).
Exocoetus katoptron Bleeker, Ned. Tijdschr. Dierk., 3, 1866: 115; Atl. Ichth., 6, 1866–1872: 72. Günther, Cat. Fishes Brit. Mus., 6, 1866: 289; Fische der Südsee, 8, 1909: 367.
Exocoetus altipinnis Day, Proc. Zool. Soc. London, 1888: 265; Fishes Brit. India, 1878–1888: 807.
Cypsilurus katoptron Jordan and Seale, Bull. U. S. Bur. Fish., 25, 1905 (1906): 211, fig. 16 (Samoa).
Cypsilurus altipinnis Seale and Bean, Proc. U. S. Nat. Mus., 33, 1908: 240.
Cypselurus katoptron McCulloch, Rec. West. Austr. Mus., 1 (2), 1912: 84.
Cypselurus altipennis Weber and de Beaufort, Fishes Indo-Austr. Archip., 4, 1922: 184.
? Exocoetus arcticeps Günther, Cat. Fishes. Brit. Mus., 6, 1866: 289 (China). Macleay, Proc. Linn. Soc. N. S. Wales, 1883: 278.
? Cypsilurus arcticeps Jordan and Seale, Bull. U. S. Bur. Fish., 25, 1905 (1906): 211. Weber and de Beaufort, Fishes Indo-Austr. Archip., 4, 1922: 182.
? Exocoetus hexazona Bleeker, Nat. Tijdschr. Ned. Indie, 4, 1853: 206; Ned. Tijdschr. Dierk., 3, 1866: 118; Atl. Ichth., 6, 1866–1872: 73.
? Cypsilurus hexazona Weber and de Beaufort, Fishes Indo-Austr. Archip., 4, 1922: 185.
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—J. T. NICHOLS and C. M. BREDER, JR., *American Museum of Natural History, New York City.*

ON A FOSSIL FLYING FISH FROM CANADA.—During the Triassic there were present in the seas of Europe 3 genera of flying fishes, *Dollopterus* Abel, of the family Perleididae, and *Thoracopterus* Bronn and *Gigantopterus* Abel of the Pholidophoridae. These genera are treated in length by O. Abel in his *Fossile Flugfische*.[1] In 1916 L. Lambe[2] described a fish from the lower Triassic, from near Banff, Alberta, Canada, which he named *Elonichthys cupidineus*. The type specimen, more than 30 cm. long, lacks the caudal fin, and the restoration of the caudal given by Lambe is undoubtedly wrong. On account of its large pectoral fins, the species is a typical flying fish closely allied to *Dollopterus*. It has nothing in common with *Elonichthys*, a genus of the family *Palaeoniscidae*, which ranges from the lower Carboniferous to the lower Permian. It is not improbable that *Dollopterus cupidineus* (Lambe) constitutes a separate genus. As stated by Lambe, the rays of the dorsal and anal fins stand rather far apart, whereas in the known forms of *Dollopterus*[3] they are closely set.—LEO S. BERG, *Leningrad, U. S. S. R.*

[1] Bull. U. S. Nat. Mus., 47, 1896: 740.
[2] Bull. Am. Mus. Nat. Hist., 46, 1922: 506.
[3] Zoologica, 8, 1928: 17.

[1] Jahrb. Geol. Reichsanst. Wien, 56 1906: 1–88.
[2] Trans. Roy. Soc. Canada, Sect. IV, (3) 10, 1916: 39–42, pl. 2.
[3] Cf. Stolley, Palaeontographica, 63, 1920.

SOME HABITS OF *AMPHIPRION* IN RELATION TO SEA ANEMONES.[1]—For many years I have been greatly interested in the habits of certain small and very brilliantly colored damsel fishes, members of the family Pomacentridae. This family is represented in tropical waters by a great variety of species, many of which are very conspicuous about wharves as well as on coral reefs.

A few species go in schools which are either free swimming or live near large branching corals, into which they disappear when alarmed. Most of them, however, have definite homes. A pair takes up its abode in a crevice of some pier or finds a hole in or under a rock or in some reef. This home is zealously guarded and all intruders are attacked, and if possible are driven away. The habits of these home-makers are both diverting and interesting, and one may spend many hours watching them.

There is another group of damsel fishes whose home-making habits are entirely different and far more interesting. Instead of preempting some unoccupied hole or cranny, these daring little fishes have a living house—a house so protected that no ordinary foe dare attack them when they have entered the portal of their strange abode. This living home is within the tentacles and gullet of certain large to gigantic sea-anemones, of the genera *Stoichactis* and *Discosoma*, widely distributed through the Indo-Pacific realm.

At least 6 species of damsel-fishes are known to take up their abode in as many species of sea anemones, which may attain a diameter of 16 to 24 inches or more. The fish most commonly observed living in sea anemones is the lovely and very active little harlequin fish, *Amphiprion percula*. It has been taken from them in the Andaman Islands and Philippines, and eastward to the Carolines and Fiji Islands. I have myself taken it from sea anemones at Singapore, the Philippines, the Carolines, Waigiu and the Solomon Islands.

Other species taken from sea-anemones and observed in captivity for nearly 2 years by my friend and colleague, Dr. James W. Chapman, of Silliman Institute, Dumaguete, Oriental Negros, Philippine Islands, are the following: *Amphiprion frenatus* Brevoort, *Amphiprion perideraion* Bleeker, *Amphiprion polymnus* (Linnaeus), and the very closely related *Premnas biaculeatus* (Bloch).

I took 5 specimens of *Amphiprion frenatus* from an enormous sea anemone on a reef near Suva, Viti Levu Island, Fiji. There is no question that all the species of *Amphiprion*, as well as *Premnas biaculeatus*, inhabit sea anemones and dwell with them in amity and mutual helpfulness. A male, much the smaller, and a female usually take up residence in a sea anemone. Occasionally they live in separate hosts and visit back and forth. When the young are large enough to fend for themselves they are driven out to seek their own homes. As many as 7 of *Amphiprion percula* have been found in 1 sea anemone.

Amphiprion percula is known to live in 4 species of sea anemone, but the larger species of *Amphiprion* are each limited to a single kind of host, with length of tentacles, exposure to light, depth of water inhabited, and other factors suited to the particular needs of the guest. We may safely say that the range of the species of *Amphiprion* is limited by the presence or absence of the proper sea anemone hosts. On many reefs every large *Discosoma* or *Stoichactis* contains at least one *Amphiprion* and may have several, ranging in size from tiny ones perhaps 10 mm. long to adults from 60 to more than 100 mm. in standard length.

According to the extensive series of experiments carried on at the Silliman Institute aquarium there is a true symbiotic relationship between the sea anemone host and its self invited guests. How or why the amphiprions escape death or injury from the myriad lasso cells of the sea anemone is a mystery which as yet we cannot explain. When other species of small fishes were placed in the aquarium they were promptly killed if they came too close to the tentacles of the sea anemone. Small shrimps and various other kinds of small marine animals were killed almost instantly by the sea anemone. But when an *Amphiprion* darted in among the beautiful but dangerous tentacles they curled away from the intrepid invader. The amphiprions are feeble swimmers, never venturing more than a short distance from home, but fleeing to the safety and seclusion of the tentacles when alarmed.

The advantage is not altogether on the side of the guests. It is a true symbiosis,

[1] Paper read at the last meeting of the Western Division of the Society, at Seattle.

for host and guests are mutually helpful, as experimentation readily shows. Place in an aquarium a fine *Stoichactis,* some specimens of *Amphiprion* of the proper species and a like number of other small fishes of about the same size. Then cut up shrimps or other tid-bits and drop in the tank. Immediately the hungry fishes dart for the food. You will find a marked difference in the behavior of the amphiprions and that of the other fishes. The latter each seize a fragment and scurry away to some nook where the food can be eaten with safety, without having others trying to snatch it away. When one morsel is finished, the fish returns for another portion.

The amphiprions have a very different reaction. They too dart upon the food, but make no attempt to eat it. Instead, each fish seizes a mouthful, hurries to the sea anemone and drops its food among the tentacles. Then it rushes back for another bit which in turn is quickly placed in storage, and keeps this up till all the food is gone. In this manner several amphiprions may place food in a single sea anemone. When no more food is left to be carried, the amphiprions, who have secured a much larger share of food than the other kinds of fishes, enter the charmed circle of stinging tentacles and feast at their leisure. Thus sea anemone and fish are both abundantly fed.

Sometimes the amphiprions bite off a mouthful of tentacles, or feed upon mucus or buds. Dutch investigators at Batavia, Java, found that the guest fish help the sea anemones by circulating water, and by rubbing and otherwise caring for sick or over-exposed hosts help them revive. They also claim that amphiprions never enter the body cavity of the sea anemone, but it seems evident that at least some of those I have observed enter the gullet.

The species of *Amphiprion* are able to recognize the kinds of sea anemones which they utilize has hosts, even when contracted, and pay no attention to other species.

Supt. Alvin Seale, of the Steinhart Aquarium, San Francisco, placed specimens of *Amphiprion percula* in a tank containing the large local sea anemone, but the fish paid no attention to it. This is just what one should expect. It would have been most astonishing had they acted otherwise.—ALBERT W. C. T. HERRE, Natural History Museum, Stanford University, California.

OCCURRENCE OF THREE SPECIES OF ANADROMOUS FISHES ON THE NOVA SCOTIAN BANKS DURING 1935 AND 1936.—Information on the distribution of anadromous fishes in the off-shore waters is very limited. During 1935 and 1936 an opportunity presented itself, through the cooperation of Canadian steam trawlers, to get data on the occurrence of the 3 anadromous fishes of Nova Scotia.

Petromyzon marinus Linnaeus.—A specimen was taken by the steam trawler *Viernoe,* Capt. F. Tidman, on March 21, 1936, in a depth of about 86 fathoms, north of Emerald bank (43° 50′ N. Lat., 62° 25′ W. Long.). It was a male, 313 mm. long, with two dorsal fins well separated, and with the intestine full of a reddish mass, which probably represented blood and muscle of a fish on which the lamprey had recently fed. The specimen was collected by Mr. W. Matthews, a member of the crew.

Pomolobus pseudoharengus (Wilson).—During the period from March 5 to 11, 1936, several United States and Canadian steam trawlers made very large catches of gaspereau, southeast of Emerald bank, while they were fishing for haddock. According to the information of Mr. J. Maher, Wireless Operator of S. T. *Viernoe,* these fish were taken in particular abundance on March 5, 1936, in about 43° 15′ N. Lat., 63° 00′ W. Long., while fishing in from 60 to 80 fathoms. The quantity of gaspereau in every haul varied from 3000 to 4000 pounds. S. T. *Rayon d'Or,* Capt. H. S. Hansen, reported a catch of 50 barrels of 200 pounds each in about the same locality on March 11, 1936. Some specimens of this catch were examined by the author.

Alosa sapidissima (Wilson).—Capt. A. E. Calder, Master of the Biological Board research vessel *Zoarces,* during his trip on the steam trawler *Rayon d'Or* (Capt. H. S. Hansen) on March 8, 1935, reported a catch of between 25 to 30 large (4- to 6-pound) shad in each haul of the otter trawl, taken in about from 45 the 50 fathoms southwest of the Middle Ground (about 44° 25′ N. Lat., 61° 05′ W. Long.).

Hence, at least during certain years, these anadromous fishes may be found quite far off the shore.—VADIM D. VLADYKOV, *Biological Board of Canada, Atlantic Biological Station, St. Andrews, New Brunswick.*

Herpetological Notes

REPTILE RECORDS FROM STAFFORD COUNTY, VIRGINIA.—Over a period of some years occasional summer visits to the village of Onville, Virginia, which is situated in Stafford County near Aquia Creek, have afforded opportunity for a number of incidental observations upon the reptilian fauna of the region. Since there appear to be no records in the literature regarding this particular locality it seems advisable to make these observations available. All the species here noted have been recorded from the District of Columbia and adjacent parts of Virginia in a paper by Hay (1902) and all are also included in Dunn's (1918) list of the reptiles and amphibians of Virginia. In the latter paper an attempt is made to give specific records of the occurrence of the various forms in the counties of the state. It appears that at this time there were no available records for Stafford County although the adjoining counties of Fauquier and Prince William are represented. Stafford County lies partly in the Piedmont Plateau and partly in the Coastal Plain of Virginia and its eastern and southern borders are formed by two rivers, the Potomac and the Rappahanock. The present list is not complete for the whole county, but only for a part of the northwestern section. This region lies on the Piedmont Plateau near its eastern boundary, the "fall-line," and is underlain by Pre-cambrian granites and granite-gneisses. Through it pass Aquia Creek and two of its small tributaries, Beaver Dam Run and Long Branch. The land is sparsely farmed and is mostly covered by second growth hardwood and pine forest. The elevation is not greater than 350 feet above sea level. All the species considered here are represented in the writer's collections but the number of specimens in the collection bears no relation to the relative abundance of the species. The area under observation is so small that indiscriminate collecting might easily be a serious drain upon its reptilian population. Therefore as a general rule only one or two specimens of each form have been retained.

An annotated list of the species observed follows. Catalogue numbers refer to the museum collection of Johns Hopkins University.

1. *Sceloporus undulatus* (Latreille).—The most common lizard. Found frequently on the walls of houses and barns as well as in the woods and fields. As has been noted before for another species (Newman and Patterson, 1909) particular individuals, if undisturbed, can be observed to inhabit the same tree or building over considerable periods of time.

2. *Cnemidophorus sexlineatus sexlineatus* (Linnaeus).—This species is apparently of rare occurrence; only five specimens have been recorded.

3. *Eumeces fasciatus* (Linnaeus).—Not nearly so common as *Sceloporus*. It is most often seen on certain steep boulder-strewn hillsides which border Aquia Creek. Old sawdust piles left from former milling operations along the creek also appear to be favorite habitats.

4. *Leiolopisma unicolor* (Harlan).—Rare. Only one individual (J.H.U. 64) has been seen. It was collected August 12, 1928, from beneath a log. Body length 41 mm., tail length 64 mm.

5. *Carphophis amoena amoena* (Say).—The ground snake appears to be quite common. Four specimens, all of which were taken from beneath stones in the woods, are preserved in the collection. All seem to be quite typical of the subspecies *amoena* as defined by Blanchard (1924). The prefrontals are separate from the internasals. Supralabials, 5; infralabials, 6; temporals, 1–2 in three specimens, 1–1 in No. 241.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
72	Aug. 20, 1928	♀	13–13–13	130	30	151	22
73	Aug. 21, 1928	♂	13–13–13	123	34	163	26
147	Sept. 14, 1932	♂	13–13–13	123	32	211	35
241	Sept. 17, 1933	♀	13–13–13	131	28	248	32

6. *Diadophis punctatus edwardsii* (Merrem).—Common in the woods under stones and logs. Both specimens in the collection were obtained on August 19, 1928. Both show a variation in the supralabials. No. 67 has 8 on the left side but 7 on the right; apparently as a result of fusion of supralabials 2 and 3 on the right side. No. 68 has 7 on the left and 8 on the right, due to fusion of left supralabials 5 and 6. In both specimens: infra-

labials, 8; oculars, 1–2; temporals 1–1. No. 67 has lost a portion of the tail.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
67	Aug. 19, 1928	♀	15–15–15	156		408	
68	Aug. 19, 1928	♂	15–15–15	150	50	354	73

7. *Heterodon contortrix* (Linnaeus).—A fairly common snake in the drier upland regions. Both specimens collected have supralabials, 8; infralabials, 10.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
61	Aug. 6, 1928	♀	25–23–19	135	43	713	106
62	Aug. 6, 1928	♀ (juv.)	25–23–19	141	39	200	29

8. *Opheodrys aestivus* (Linnaeus).—Of fairly frequent occurrence. The colloquial name, pine snake, refers to the fact that it is commonly to be found among scrub pines. The single specimen preserved is typical. Supralabials, 7; infralabials, 8; oculars, 1–2; temporals, 1–2.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
75	Aug. 21, 1928	♂	17–17–15	155	129	665	260

9. *Elaphe obsoleta obsoleta* (Say).—Common. Frequently seen about houses and barns as well as in the woods. The writer once came upon a specimen about 5 feet in length in the process of attempting to swallow a *Natrix* about 3 feet long. It was during a period of drought in August, 1927, and the two snakes lay in a dry stream-bed. The black-snake had grasped its prey a short distance anterior to the vent and was attempting to swallow it in this looped condition. Although its head was entirely free, the water-snake made no apparent efforts either to resist or escape. It was obviously being constricted rather vigorously by two loops of the black-snake which had been thrown around its trunk. Whether the latter would have succeeded in engulfing this large prey is not known, for after observing the struggle for about fifteen minutes the writer moved closer to obtain some photographs; the black-snake thereupon released its victim with some difficulty and glided away. The water-snake, though temporarily incapacitated, later recovered and took refuge beneath a stone.

All the specimens collected are typical for *obsoleta*. Only a juvenile specimen collected August 7, 1928 seems worthy of description. It has 32 dorsal blotches on the body, 12 on the tail. Supralabials, 8; infralabials, 11; oculars, 1–2.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
63	Aug. 7, 1928	♀ (juv.)	25–27–19	236	75	377	64

10. *Natrix sipedon sipedon* (Linnaeus).—This is probably the most common snake of the region. Nearly every rock-pile or mass of drifted brush along Aquia Creek harbors one or more of this species. The two specimens here described have: supralabials, 8; infralabials, 10; oculars, 1–3. No. 38 has temporals, 1–3 but No. 94 has 1–3 on the left side, 1–2 on the right.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
38	June 16, 1928	♀	23–21–19	137	64	873	190
94	Sept. 17, 1928	♀	25–23–19	136	64	865	196

11. *Storeria dekayi* (Holbrook).—Apparently not common. It has, however, been recorded several times in the same situations as *Carphophis* and *Diadophis*.

12. *Virginia valeriae valeriae* Baird and Girard.—This species must be regarded as rare. Only a single specimen has been found, plowed up in soft ground in the spring of 1935. It seems typical of the subspecies as defined by Blanchard (1923) but may be worthy of detailed description. Supralabials, 6; infralabials, 6; oculars, 0–2; temporals, 1–2; on each side the parietal and fifth supralabial meet between the post-oculars and the temporal. Tail divided by body length equals .146.

Mus. No.	Date	Sex	Dorsals	Ventrals	Caudals	Length	Tail length
520	May 23, 1935	♀	15–15–15	123	26	218	32

13. *Thamnophis sirtalis sirtalis* (Linnaeus).—The garter snake is not so common as might be expected. Only three or four specimens have been seen over a period of ten years, but all of these belonged unmistakably to this species.

14. *Agkistrodon mokasen mokasen* Beauvois.—The copperhead is very abundant. During the summers of 1927–1930 the writer was particularly interested in this species and collected over 60 adults from this restricted region. Unfortunately most of these were dissected with little attention being paid to their scutellation so that they are not available as records for the present purpose. The great majority of these snakes were found on rocky hillsides bordering Aquia Creek and in the slab piles of abandoned saw-mill sites in the woods. A number were found, however, along road sides and in open fields. The oft-mentioned gregariousness of this species was brought out strik-

ingly during this collecting, for a locality where one snake was found usually repaid revisitation by yielding three or four more individuals.

The number of specimens in the collection precludes the possibility of giving descriptions of all. Many of them are young individuals born in the laboratory. Most have a formula for the dorsal scales of 23–23–19. The number of ventrals varies from 147–153, the caudals from 44–50. Supralabials, 8; infralabials, 10; oculars, 2–5.

15. *Sternotherus odoratus* (Latreille).—This species is common in Aquia Creek and Beaver Dam Run. No. 54 has a carapace 86 mm. long and 61 mm. wide. The plastron is 64 mm. long and 26 mm. wide just behind the bridge.

16. *Kinosternon subrubrum subrubrum* (Lacépède).—*K. subrubrum* occurs with *S. odoratus* seemingly in about equal abundance. Measurements of two specimens are as follows: No. 55—length of carapace, 87 mm.; width 61 mm.; length of plastron 75 mm.; width 36 mm.; No. 56—length of carapace, 102 mm.; width 75 mm.; length of plastron, 87 mm.; width 40 mm.

17. *Chelydra serpentina* (Linnaeus).—Also common in Aquia Creek. Most specimens are rather small, the largest seen having a carapace about 10 inches long.

18. *Terrapene carolina* (Linnaeus).—The box turtle is an ubiquitous inhabitant of the woods and fields. One rarely walks any distance without seeing one or two of them. Most of the specimens in the collection were retained because they exhibit some variation in the number or arrangement of the scutes.

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W. GARDNER LYNN, *Johns Hopkins University, Baltimore, Maryland.*

A CANNIBALISTIC HOG-NOSE SNAKE.—On June 17, 1935, Fred Taggert, reptile keeper in the New York Zoological Park, informed me that a hog-nose snake, *Heterodon contortrix*, from southern New Jersey, had eaten a ribbon snake, *Thamnophis s. sauritus*.

The *Heterodon*, 490 mm. long, grasped the *Thamnophis*, 325 mm. long, by the head and immediately proceeded to swallow its victim. Little resistance was offered by the ribbon snake.

This appears to be an unrecorded and unusual feeding habit of *Heterodon*, which usually limits its food to frogs and toads, preferring the latter.—ARTHUR M. GREENHALL, *251 W. 89th St., New York City.*

ANEIDES FLAVIPUNCTATUS IN BURNT-OVER AREAS.—While collecting in the redwoods near Yorkville, Mendocino Co., California, November 27, 1932, I found a small population of *Aneides flavipunctatus* concentrated in a little cleared "island," apparently burnt over after logging. Here under charred slabs these salamanders were quite common (six were taken in about half an hour) together with *A. lugubris, Ensatina eschscholtzii* and *Batrachoseps attenuatus*. No *flavipunctatus* had been secured in a whole morning's search through the surrounding forest. Subsequent experiences in this place were very similar. March 30, 1933, and November 2, 1933, in this vicinity, we secured no specimens of *flavipunctatus* except under charred debris in the little clearing.

More recently, February 23, 1935, a similar situation was observed near Comptche, Mendocino Co., California. After two or three hours' collecting, which had produced many salamanders but no *flavipunctatus*, through redwood forest and cleared, more or less brushy sections, a search was started on a burnt hill slope covered with blackened logs and debris. Almost immediately a *flavipunctatus* was secured. Three more were taken, along with several specimens of *A. lugubris*, in a few minutes.—WALLACE F. WOOD, *1608 Fernwood Drive, Oakland, California.*

SOME OBSERVATIONS ON *XANTUSIA VIGILIS* BAIRD.—The following study is based on a series of one hundred and six specimens of the desert night lizard collected from eight different localities in the southern part of California. Thirty of the lizards were collected by Dr. S. F. Wood in a forest of Joshua trees (*Yucca brevifolia*) two miles west of Palmdale, Los Angeles County, on December 30, 1934. The low temperature prevailing at this season made it possible to capture the lizards more easily and to transport them alive to the laboratory. Twenty-seven lizards came from Victorville, which is east of Palmdale, and twenty-seven from near Mojave, which is north of Palmdale. The other specimens came from scattered localities.

The thirty *Xantusia* were kept alive in the laboratory for a period of three weeks, then were preserved in formalin. This gave an opportunity for observing something of their behavior and also the recording of their colors.

This group of lizards was kept in a small glass terrarium in a cool room except during the periods of observation. Water was supplied in a tiny dish. This they drank by lapping it up with the tongue. Two feeding experiments were tried. A few small meal worms were dropped onto the sand and their movements soon attracted the attention of two of the lizards. The lizards did not dash up and seize a worm but stalked their prey before seizing and devouring it. When seizing a worm *Xantusia* holds its head in a position similar to that assumed by *Gerrhonotus* when feeding. One evening a few large juicy aphids were dropped into the jar containing five of the young *Xantusia*. The young lizards stalked the slow moving aphids, approaching they tested the insects with their tongues, and finally seized them. One large aphid made an extremely large mouthful for a young *Xantusia*. The aphid was well chewed, the lips licked, and then the lizard was ready to look for another aphid. The lizards did not seem to object to the aphids crawling all over them with one exception—they would not tolerate them on their toes.

No attempt was made to study the change in color or to discover the causes responsible for the changes. Dr. Atsatt (1931: 84) has undertaken this difficult problem and is continuing her work on this genus. The following general observations were made; that the dark phase seems to be characteristic for the day time, and the light phase for the night. It was noticed also that the young individuals are at all times much darker than the adults, and if there is a color change the contrast is less marked.

All color records were made during the early evening when the lizards were all in the light phase. A blue daylight electric light was used. In order to be as accurate as possible in matching the colors both Ridgway's (1912) color charts and the lizards were put under a dissecting binocular. The dorsal colors proved to be much more complicated than was at first expected, while the colors on the ventral surface presented difficulties that made the binocular of little value. The dorsal tubercules contained so many melanophores of varying size that the actual ground color was veiled. On the ventral side the body wall was so thin that the colors of the internal organs modified the color over large areas.

Contrary to all expectations these lizards were easy to handle whether on the hand, on the table, under the binocular or on the stage of the compound microscope. They would remain where they were placed and hold any position desired and remain that way until changed. All color records were completed first, then a series of measurements were made. It would be quite possible to watch the expansion or contraction of the melanophores under the compound microscope in living *Xantusia* since they are so docile.

As mentioned above the recording of the colors for this species presented many difficulties. Both Cope (1900: 545) and Van Denburgh (1, 1922: 478) record a general color description that shows something of the range within the species. Atsatt (1931: 87) gives an exact color record for one individual in both the light and dark phase. As far as known this is the only exact color record made for this species.

The exact color records for the thirty living *Xantusia* were made during the light phase. These have been arranged in tabular form and selections from this follow. In general the background color is grayish or yellowish and of a transparent quality. Scattered throughout each tubercle are many black melanophores of varying sizes from the smallest dots to others large and multibranched.

All the measurements included in this paper are for preserved specimens. The range

COLORS OF LIVING *XANTUSIA VIGILIS*

	Head				Body		Tail		
	Nose	Stripes	Dorsal	Ventral	Dorsal	Ventral	Dorsal	Ventral	
618	Orange-Citrine 4k*	Old Gold 16	Olive-Citrine 16	Pale Smoke Gray 46	Grayish Olive 46	Light Celandine Green 47	Dark Olive-Buff 40	Pale Drab-Gray 46	
620	Isabella Color 30i	Cream-Buff 30d	Buffy Olive 30	Pale Drab-Gray 46	Vetiver Green 47	Mineral Gray 47d	Ecru-Olive 30	Pale Ecru-Drab 46f	
622	Isabella Color 30i	Antimony Yellow 15	Buffy Olive 30	Pale Drab-Gray 46	Buffy Olive 30	Mineral Gray 47d	Light Ochraceous Buff 15	Light Buff 15	
624	Orange-Citrine 4k	Deep Colonial Buff 30	Dark Citrine 4	Pale Gull Gray 53	Deep Olive-Gray 51	Light Mineral Gray 47f	Light Olive-Gray 51	Pallid Neutral Gray 53	
626	Orange-Citrine 4k	Buff-Yellow 4d	Olive-Citrine 16	Pale Drab-Gray 46	Buffy Citrine 16k	Light Olive-Gray 51	Pale Ochraceous-Buff 15	Pale Smoke Gray 46	
630	Buffy Citrine 16k	Light Ochraceous Buff 15	Olive-Citrine 16	Pearl Gray 52f	Deep Olive-Gray 51	Pearl Gray 52f	Light Brownish Olive 30k	Pale Olive-Gray 50	
634	Sudan Brown 3	Ochraceous-Buff 15	Chaetura Drab 46	Light Mouse Gray 51	Chaetura Drab 46	Purplish Vinaceous 39b	Drab 46	Light Drab 46	immature
636	Olive Lake 16	Naples Yellow 16d	Olive-Citrine 16	Pale Olive-Gray 51	Deep Olive-Buff 40	Gull Gray 53	Light Grayish Olive 46	Pale Olive-Buff 40	
640	Buffy Citrine 16k	Warm Buff 15'	Chaetura Black 46	Pale Mouse Gray 51	Chaetura Drab 46	Hatter Gray 52b	Hair Brown 46	Smoke Gray 46	immature
642	Buffy Citrine 16k	Light Ochraceous-Buff 15	Olive-Citrine 16	Light Mouse Gray 51	Dark Grayish Olive 46	Deep Quaker Drab 51i	Ochraceous Buff 15	Pale Mouse Gray 51	immature
643	Old Gold 16i	Light Ochraceous-Buff 15	Olive-Citrine 16	Pale Mouse Gray 51	Brownish Olive 30n	Neutral Gray 53	Light Brownish Olive 30k	Smoke Gray 46	immature
644	Old Gold 16i	Warm Buff 15'	Deep Grayish Olive 46	Pale Mouse Gray 51	Hair Brown 46 ..	Deep Quaker Drab 51i	Saccardo's Olive 16m	Smoke Gray 46	immature
645	Buffy Citrine 16k	Light Ochraceous-Buff 15	Dark Olive Gray 51	Pallid Neutral Gray 53	Deep Olive Gray 51	Light Olive-Gray 51	Pale Olive-Buff 40	Pale Drab-Gray 46	

* Plate numbers in arabic to save space, original are Roman numerals.

in total length is 3.92 to 10.18 cm. This includes immature, young and adult individuals from the several localities. The measurement from the tip of the snout to the anus gives a range of 2.17 to 5.09 cm. with a distribution as follows: 2.1 (2), 2.2 (4), 2.3 (3), 2.4 (2), 2.5 (2), 3.2 (5), 3.3 (3), 3.4 (3), 3.5 (14), 3.6 (9), 3.7 (7), 3.8 (11), 3.9 (10), 4.0 (6), 4.1 (9), 4.2 (5), 4.3 (4), 4.4 (5), 4.5 (1), 5.0 (1). The length of the head from the tip of the snout to the posterior edge of the occipitals gives the following range and distribution: range 0.61 to 0.93 cm., distribution .60 to .70 (13), .75 to .80 (10), .80 to .90 (74), .90 to .94 (8).

There is a great individual variation in the number and arrangement of the labials. Van Denburgh (1, 1922: 478) says that there are "Four or five superior and three or four inferior labials to a point below the middle of the eye." In general this is true, but in this series there was found to be almost as much variation in the number of labials anterior to the eye as in those posterior to it, and a greater variation in the size of the scales posterior to the eye than in those anterior to it (Fig. 1). Cope (1900: 545) says there are eight upper labials and seven lower labials on either side. Eight is the most common number of supralabials without a doubt, while the infralabials vary almost *ad infinitum*. The number of scales bordering the oral opening vary but not to as great an extent as the total number of labials. The posterior angle of the mouth opening proper occurs usually under superior labial 6 and over inferior labial 5. Beginning with these last two and posterior thereto the labials vary greatly in number and size. Of the true labials the upper vary less frequently than the lower, where the scales lower 3 and 4 seem to be subject to the most variation. The diagrams illustrate a few of the arrangements observed, especially the more common ones.

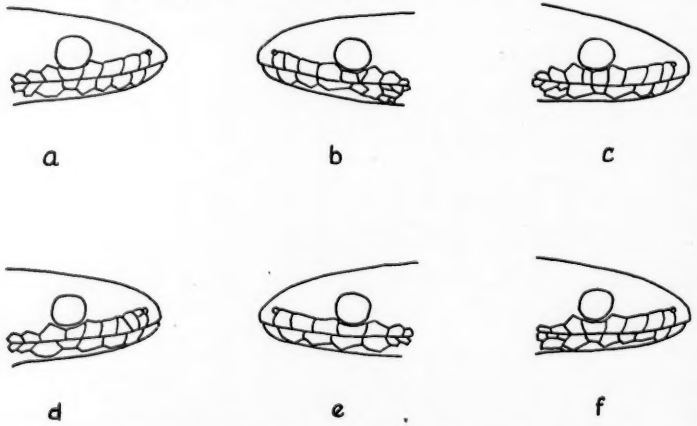

Fig. 1. *a–f*, diagrams showing some of the variations occurring in the labials. *a*, the average or normal arrangement.

Rarely is there any variation in the arrangement of the dorsal head scales. Three individuals showing interoccipital scales came from near Weldon, Kern County, and two from La Puerta Valley, San Diego County. One individual with a very abnormal arrangement of head scales was captured near Mojave in Kern County.

The number of large scales present on the second gular fold varies considerably. Two was the smallest number found and ten the largest with the average at six. The number of femoral pores was recorded and found to show a tremendous amount of variation. Van Denburgh (1, 1922: 478) found the number to vary between six and ten, Cope (1900: 545) found nine or ten in a rather inconspicuous series. In the group of *Xantusia* studied the femoral pores were inconspicuous in the immature individuals and quite obvious in all the other specimens. They varied in number in a series from five to eleven. The same number of pores did not always occur on both sides of an

individual. Perhaps the majority of the individuals fall in the following three groups, 7—7, 8—8, 9—9, with 8—8 the average.

The most constant feature was the number of longitudinal rows of central scutes. There are always ten complete rows with two lateral incomplete rows. Only one exception was found, an individual where transverse rows ten to fourteen inclusive had the midventral scutes subdivided so that the rows were increased to thirteen and fourteen scales per row. Counting the number of transverse rows from anterior to posterior and including all of the preanal scales the range in number was found to be 29 to 33½

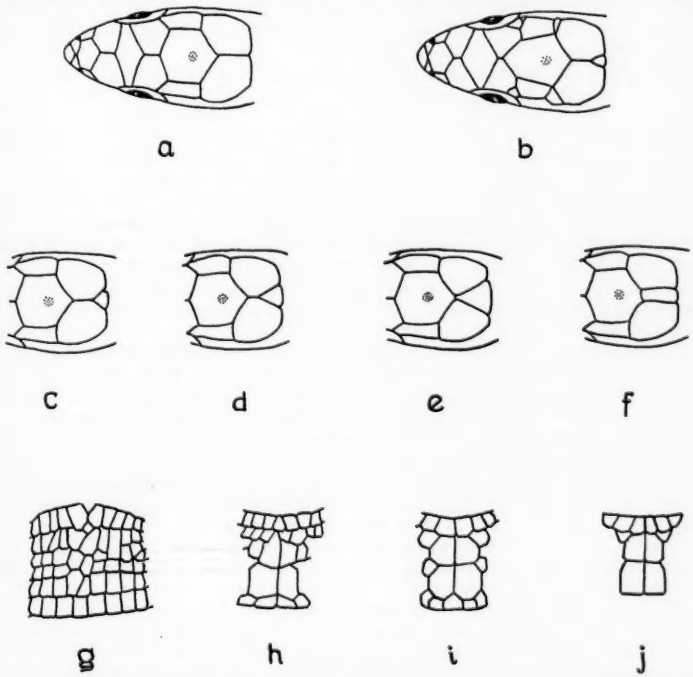

Fig. 2. *a*, the normal arrangement of the large dorsal head plates. *b–f*, some variations of the head plates. *g*, first five rows of the ventral scales showing numerous irregularities. *h–j*, some modifications in the preanal region.

with the average at 31 rows. All of the variation occurring in the number of transverse rows was found to be almost entirely limited to the first five to seven thoracic rows or the posterior four or five rows. Rarely was an individual found showing partial rows in the midabdominal region.

Several of the immature individuals were so young that the "umbilical" scar showed quite distinctly on the midventral line. The scar was located in one or two transverse rows, usually row 19 or 20 or both, and once as far anterior as row 17. These were all captured on December 20th at Palmdale. This observation was found to hold good for the other localities. One immature individual with the scar showing was taken in September near Mojave in Kern County. Another immature one with scar between 20 and 21 was taken in November. Most of the young individuals in the Museum's collection were captured in March or April and were too old to show any trace of a scar. It would seem from this and Van Denburgh's records that the young of this species are born usually between the middle of September and the first of January.

The lateral body folds were present in all the living specimens observed, also the

last gular fold shows as a distinct fold at all times. The first gular fold seldom showed in the living individuals but appeared in all the preserved specimens.

Of the specimens studied 66 are in the collections of the Museum of Vertebrate Zoology and 30 in a private collection.

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THE NORTHWARD OCCURRENCE OF *BUFO CALIFORNICUS* IN CALIFORNIA.—In a discussion of the status of *Bufo californicus*, Myers (Proc. Biol. Soc. Wash., 43, 1930: 73–78) says that this little known amphibian "doubtless occurs somewhat to the north of Santa Paula, . . . and it may reach Santa Barbara." This suspicion was more than borne out by the discovery of *californicus* in the upper Salinas River, 3 miles northeast of Santa Margarita, northern San Luis Obispo County, California. The occurrence here constitutes an extension of the known range 115 miles northwest from Santa Paula, the type locality and northernmost station heretofore listed. There intervenes a considerable mountainous region with drainage systems, such as the Santa Maria River, that would afford suitable habitat for this species.

Three specimens, Nos. 20507-20509, Mus. Vert. Zool., were taken at the Santa Margarita locality on the night of June 12, 1936. The river course, at an elevation of 1000 feet, here is closely bordered by low hills with occasional sparse stands of digger pine among the oaks. The general aspect of the land biota is high Upper Sonoran. The river bottom has marginal growths of oaks and cottonwoods on sandy benches with willow and *Baccharis* thickets bordering the stream. The small flow of clear water gave promise of continuing well through the summer. The stream subdivided frequently and at places formed comparatively quiet pools in the gravel as much as 18 inches deep. It was within a few feet of one of these that a trilling animal was watched in the beam of a flashlight as it sat half submerged in a puddle not more than 2 feet across. The fore part of the throat was moderately distended, not to compare with the *Hyla regilla* which were calling on all sides.

Much difficulty was encountered in stalking the toad while trilling. It stopped first when approached within fifty feet. Only after a long interval did it begin calling again so that a search at close range with the light finally could be made. The outbursts from an excitable killdeer with young on a nearby gravel bar seemed to quiet the toad. Three animals were trilling, spaced about equally along a quarter-mile of stream bed. The trill is musical and ventriloquistic as described by Klauber (COPEIA, 1932, 3: 119) and by Myers (*loc. cit.*), yet there is considerable resemblance to the louder, more raucous call of *cognatus*, even granting the difference which Myers emphasizes. Two specimens were taken on a sandy bench as they moved about, rustling the oak leaves.

These facts relative to habitat, season and actions coincide in detail with conditions described as existing in San Diego County by Klauber and Myers. Such coincidence emphasizes the adherence of the species during the breeding season to a certain type of arroyo stream bed over its fairly large range that is now known to extend from the west slopes of the San Pedro Mártir Mountains (Klauber, COPEIA, 1931, 3: 141) northward, and eastward to Victorville on the Mojave River (Klauber, 1932). It is reasonable to suppose that further collecting in central California in suitable places during the breeding season will reveal a considerable distribution in this region of the state, if only along the extensive Salinas River drainage. Comparison of the Santa Margarita specimens with those from San Diego County and Lower California showed close agreement in structure. Certain variations in color seemed best attributed to differences in mode of preservation.—LOYE MILLER and ALDEN H. MILLER, *Museum of Vertebrate Zoology, Berkeley, California.*

COURTING BEHAVIOR OF SOME WESTERN LIZARDS.—The peculiar reactions of one lizard toward another led the author to watch more closely the behavior of several *Sceloporus o. occidentalis* (Baird and Girard) kept in laboratory cages. A large male was pursuing two adult females. He would grasp a female with his jaws, usually by the left side of the neck. Either immediately after grasping the female or after a short pause, he would very actively attempt to push her over on her back. Sometimes she tried to break away and the result was that the two ran about in circles. At other times, she made no attempts to escape. Then he would roll her over on her back, all the while firmly retaining his grip on her neck. Sometimes he grasped her by the side of the body and tried to push her over but she would run forward trying to break away. Thus, the two would travel about the cage in circles until the male released his hold.

One female seemed very disturbed as shown by peculiar jerky, jumping movements. During these antics the end of her tail twitched actively and she frequently approached the male. At another time, a female jumped up and down, repeatedly raising her body and feet off the sand with very jerky movements. The male, in this case, seemed equally affected and moved about jerkily but not with as much vigor as the female. The bodies of the two lizards were curved outward from each other so that their body axes made nearly a circle. The female moved around a circle and a half in this position until distracted by movements outside of the terrarium. When she stopped, the male immediately attempted to grasp her by the side of the neck. The male is usually of the same size or slightly larger than the female but sometimes he is smaller. Although the author saw this behavior many times, copulation was never observed.

This courting activity is similar to that observed in 1934 by G. K. Noble (Natural History, 34: 3–15) for *Sceloporus undulatus.*

Courting behavior has been observed in captive *Uta stansburiana elegans* (Yarrow). In this case the male was smaller than the female, but grasped her by the right shoulder and succeeded in pushing her over on her back, exposing the white ventrum.

Several horned toads, *Phrynosoma b. blainvillii* (Gray), exhibited a similar behavior. The chief difference here was that the grip on the left side of the neck was firmer and that the lizard, raising himself on his fore legs, would jerk his head quickly to the right, at the same time pushing forward on all fours, thus turning the female over on her back.—SHERWIN F. WOOD, *Los Angeles Junior College, Los Angeles, California.*

NOTES ON SOME HABITS OF *TERRAPENE CAROLINA* (LINNÉ).—In September, 1929, I obtained a brood of 5 box tortoises, *Terrapene carolina*, which had hatched from eggs laid in June of the same year, in Montgomery County, Pennsylvania. The two smallest members of the brood died within a few weeks; their sex was not noted. The three remaining specimens consist of one male and two females.

For the first two seasons they were kept in a screen wire enclosure about 2½ feet in diameter. Curiously, during this whole time they did not care particularly for vegetables or berries; even meats were generally refused. They were, however, and still are, extremely partial to earthworms and larvae of various kinds. Tortoises I kept years ago were very fond of sour milk, but the present brood rarely touches it. On one or two occasions beheaded Japanese beetles were placed in the enclosure; these were devoured with apparent eagerness.

In the fall of 1933 I observed the male trying repeatedly to mount one of the females. In the summer of 1934 I saw undoubted attempts at mating; and in July, 1934, the continued amatory advances of the male were seemingly repulsed by the female. The male would pursue the female, biting at her shell and at exposed parts of her body; then, with head erect, neck arched stiffly, eyes apparently staring, oblivious to onlookers and proffered food, would make repeated attempts to mount her. On several occasions these attempts were successful, but actual coitus was not observed. While the male made these advances the female would retract her head, legs and tail into the shell; sometimes she managed to crawl away a short distance before the attacks were renewed.

Basing my conclusions on my observations of the three tortoises of known age, I believe that the first mating in this species takes place between the fourth and fifth years. When the above last observations were made the male measured 4¼ inches and the females 4 inches in length along the plastron.—RANDLE C. ROSENBERGER, *Jefferson Medical College, Philadelphia, Pennsylvania.*

Reviews and Comments

GEORG WILHELM STELLER. By Leonhard Stejneger. Harvard University Press, 1936: I–XXIV, 1–623, wih excellent index. $6.00.—Thirty-three years ago this month a tall gangling youth of nineteen walked into Leonhard Stejneger's stuffy, little office in the old National Museum Building. The youth boldly intimated that he planned to monograph the African chamaeleons and instead of being laughed at, as he well deserved, the youth was treated with a stately Old World courtesy which won his heart and which made him a loving admirer of Doctor Stejneger, feeling an affection which has grown deeper year by year.

No one is more keenly conscious of his own shortcomings than am I and no one could possibly hold his own work in less esteem, nevertheless some bits have been added to the store of what we know and that these bits may be crystal rather than glass is because of Dr. Stejneger's example. He helped me to get my doctorate when taxonomic work at Harvard was held, at the time, to be less than no work at all, and now we have both lived to see taxonomic theses accepted every year. *Sic tempora mutantur.*

After this rambling preface I pass to introduce the readers of Copeia to Stejneger's latest and greatest work, his life of Georg Wilhelm Steller.

To most of us the subject of this biography has been but part of some creature's name: Steller's jay, Steller's eider, Steller's sea lion, and preeminently Steller's sea cow. In these pages he really lives out for us his astounding career. To abstract this book would be to skim the cream for any reader. Suffice it to point out the high detective skill which has brought to light the details of Steller's early life. No one but a most extraordinary linguist could have ferreted out and read all the records which are the bases on which the whole work is built; the mixed German and Russian and the pure but badly written and worse spelled Russian of the contemporary archives. But all tongues are as one to our author.

What a yarn! Our young hero enters Russian service; is finally assigned to Behring's expedition from Kamchatka on the St. Peter and St. Paul. After some little delay, for the ships had to be carried piecemeal across Europe and Siberia, the expedition sets sail. Russia knew the English were pushing up the Pacific coast of North America and to increase her own fur trade she must push on her own boundaries to forestall them. So the little ships set sail with but a hazy idea of where they were really going. Steller, the unwanted young naturalist, argues and squabbles with Bering, his Commander. Such encounters between the Navy and the Scientist have been common enough in the history of scientific exploitation and have usually ended in mutual esteem. The ships sail on and the inevitable fog closes in and lasts for days and days. Food and water run short and Steller argues for a more northerly course. After hardships, which are difficult for us to imagine today, the clouds open and a gorgeous snowpeak shows up ahead. Steller begs, and finally gets permission to go ashore with a boat's crew sent to bring back fresh water. He has but a few hours ashore. He digs up some plants and shoots a bird. He comes back to the ship and dramatically announces that the land they see is America. His bird was Steller's jay and he recognized its similarity to a figure of our bluejay, for Catesby's great work had reached St. Petersburg just before he left for the East. So Alaska and Mt. St. Elias were discovered, and the first naturalist trod Alaskan soil.

What happened afterwards is a long story but the upshot was shipwreck on Bering Island. Here in a fox burrow, scooped out by hand, Steller recorded his painstaking and marvellously accurate accounts of the animals he saw and we read full accounts of the sea lions, the fur seal and their habits and much of the sea cow. Scurvy kills

many of the crew, including the Commander, and finally in a little, beach-made, open boat the survivors return to Petropavlovsk. The subsequent journeys in Kamchatka are well recounted. So also the tragic accusation of treason and the terrible denunciation "slovo i dielo." Then the trial, acquital, the long overland journey home, taken while the papers of the trial were delayed in their sending to Russia; so Steller arrives at the frontier with no proof of the successful termination of his trial and is ordered to march back to Yakutsk. But fortunately, or unfortunately, he returned only part way, when he met the papers clearing his name. In Tobolsk he encountered an old friend in the Archbishop and the latter's entertainment turned out to be largely in able liquid form. The protracted carousal may or may not have played a part in bringing on his last illness but at any rate one day in early November Steller, burning with fever, crawled into his sledge determined to travel homeward night and day. Posting went slow with only a helpless, sick man to consider and Steller got only as far as Tyuman when he died, about November 12, 1746.

This simple, little outline gives no inkling of the vast store of erudite criticism and priceless information concerning fauna, flora, geography, manners and customs and contemporary figures of importance which fill the copious footnotes and the many chapters of narrative information. One senses the painstaking enthusiasm which sustained Stejneger through over forty years of research in gathering these materials. The narrative flows well and, remember, Stejneger is not writing in his native tongue and his English puts many an author of the present day to shame. It has been one of the rare and most appreciated privileges of a lifetime to have played a small part in helping this book to see the light of day before Doctor Stejneger's 85th birthday. I hope he dances as late at his next birthday party as he did at his last.—T. BARBOUR, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

THE REPTILES OF NORTH AMERICA. By Raymond L. Ditmars. Doubleday, Doran & Company, Inc., Garden City, New York, 1936: xvi+476 pp., 136 plates, 8 in color. $6.75.—This attractive volume is a revision of the well known "Reptile Book" by the same author published in 1907 as part of the Nature Library series by Doubleday, Page & Company and reprinted several times subsequently. The new edition is subtitled "A Review of the Crocodilians, Lizards, Snakes, Turtles and Tortoises Inhabiting the United States and Northern Mexico." The purpose of the book as stated is "to simplify the identification of the North American reptiles, thus assisting the beginner in such studies and the reader seeking scattered points of information about reptile life." Dr. Ditmars' long experience with reptiles, and his contact both in person and by correspondence with many enthusiastic students and professional herpetologists, have made it possible for him to approach this objective with a truly sympathetic understanding of the needs of the amateur.

In the brief introduction are explained such elementary subjects as the significance of the binomial and trinomial forms of scientific names, with the citation of the original describer, and the importance of the more conspicuous structural features used in the classification and description of reptiles. Throughout the book technical terminology is reduced to a minimum and when used is clearly explained. Each major section (order or suborder) is preceded by a tabulation of the families and genera covered. The systematic arrangement of genera and larger groups is that in current use except for certain chapters in which, for convenience, superficially similar genera are grouped together without regard to relationships; e.g., under the heading "Sharp-nosed Snakes" the species of *Rhinocheilus, Cemophora, Carphophis, Sonora, Chilomeniscus* and *Ficimia* are described. An effort has been made to employ the scientific names now generally accepted by North American herpetologists although a number of apparently sound taxonomic papers which have appeared during recent years[1] seem to have been overlooked. Among the obsolescent names retained is *Thamnophis sirtalis ordinatus* (Linnaeus) although it is stated (p. 153) that the form has a weak standing as a subspecies. The status of *ordinatus* was fully discussed in Ruthven's monograph of the garter snakes (1908) and this name has not been in use since that time. It would have been prefer-

[1] E. g., Smith's study of *Coleonyx* (1933), Fitch's work on *Gerrhonotus* (1934), Viosca's study of the *Pseudemys troosti-elegans* complex (1933), and Stejneger's notice (1934) that [*Leiolopisma*] *lateralis* Say is preoccupied.

able to mention the *ordinatus* coloration along with the other unnamed variations listed on pages 150–151.

The numerous keys for the identification of species and subspecies are synoptic in form and based principally upon such characters as size, coloration and the more obvious structural details, but they are often so simplified as to be practically useless. For the most part, they promise to be helpful to the beginner, especially those dealing with the snakes. With the systematics of North American lizards in their present state of instability, the reviewer fully appreciates the difficulties attending the making of satisfactory popular keys to such perplexing genera as *Uta, Sceloporus, Cnemidophorus* and *Phrynosoma,* and of the author's treatment of these groups he offers no censure.

An especially praiseworthy section deals with the nature and treatment of snake poisoning. It is a conservative, unprejudiced and readable summary of present day knowledge of this much discussed subject. Treatment by means of mechanical suction and by the use of serum (antivenin) is explained and discussed. The importance of the combined use of the two methods and a warning against strong solutions of potassium permanganate are stressed. Some useful suggestions for the prevention of accidents with venomous snakes are offered.

Readers of the new edition familiar with the "Reptile Book" will be disappointed in that very little had been added, either from the author's own observations during the intervening years or from the many published sources, to the original accounts of the habits and general natural history of the various species. This disappointment will extend also to the illustrations. For reasons not stated, the plates of the "Reptile Book" have been reprinted *in toto* but placed in a separate section at the end. References to plates in the body of the work occur by number beneath the headings of the species. In the keys and text, however, attention is frequently called to illustrations without citing the plate number, an oversight which increases the difficulty of quick reference. An annotated bibliography of 19 titles refers the beginning student to additional literature in herpetology, both popular and technical. The index lists scientific and common names and many of the subjects treated.

To meet the popular demand for common names, Dr. Ditmars has listed the most frequently used vernacular names for well known species, has retained many of the "book names" suggested in the old edition, and has not hesitated to propose new ones, not only for many of the species and subspecies recently described, but also for many forms of long standing. A discussion of the difficult problem of attempting to standardize vernacular and English "book names" for North American reptiles can not be entered upon here. The reviewer, however, is dismayed to note that the present work lends encouragement to those inclined to propose common names on hasty impulse without discerning consideration of their fitness. In the opinion of the present writer, authors of popular and semi-technical publications in herpetology, in the absence of a set of standardized English names comparable to those for birds in the recent *A. O. U. Check List,* should take the matter seriously, make an effort to perpetuate vernacular names that are suitable and definite in their application, discourage the use of those that are erroneous or misleading, and use care in proposing appropriate new "book names," preferably descriptive or regional, for those lesser-known species as yet neither blessed nor cursed with a non-Latinized label. In many cases it would be well to follow the preference indicated by authors of technical monographs, where such exist, for they, presumably, have made thoughtful selections for the species which they have thoroughly studied.

The format of the book is extremely pleasing. The printing is excellent and typographical errors are very infrequent. It is strongly bound in brown buckram. Like its worthy predecessor, it is the only source of popular information on North American reptiles at the present time and it will undoubtedly be widely read and used for many years to come.—HOWARD K. GLOYD, *University of Michigan, Ann Arbor, Michigan.*

EDITORIAL NOTES AND NEWS

Summary of the 1936 Meeting

THE nineteenth annual meeting of the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS was held at the Museum of Zoology, University of Michigan, Ann Arbor, Michigan, on Monday, August 31, and Tuesday, September 1, 1936.

Sessions of August 31

THE opening session was called to order by the SECRETARY at 10:15 A.M., when 87 persons were present. In the absence of the President and Vice-Presidents of the Society, KARL P. SCHMIDT was elected chairman to preside during the meeting. After a short address of welcome by FREDERICK M. GAIGE, Director of the Museum of Zoology, the following papers were read and discussed:

1. **Fish and fisheries researches being conducted at the University of Michigan**—Carl L. Hubbs.
2. **The number of eggs and pyloric caeca as differential criteria of river races in the Atlantic salmon (Salmo salar)**—David L. Belding.
3. **Nutrition and growth in the largemouth black bass**—David H. Thompson.
4. **Spawning and migratory habits of the Columbia River steelhead trout as determined by scale studies**—John B. Long and Lawrence E. Griffin (Read by Carl L. Hubbs).
5. **Furunculosis in wild trout**—Frederic F. Fish (Read by Carl L. Hubbs).
6. **Support by the American Wildlife Institute for the publication of fisheries biology articles in Copeia**—Carl L. Hubbs.
7. **The effect of light on sexual activity in the lizard (Anolis carolinensis) with especial reference to the pineal gland**—H. J. Clausen and E. G. Poris.

The morning session adjourned at 12:00, when the members assembled for a photograph. The afternoon session was called to order at 2:15 for the reading of the following papers:

8. **Early references to the occurrence of Cichlasoma and other fresh water fishes in Hispaniola**—Luis Howell Rivero.
9. **The occurrence of the tarpon (Tarpon atlanticus) in the waters of the Panama Canal**—Samuel F. Hildebrand.
10. **Some characteristic otoliths in fishes**—Leverett A. Adams.
11. **A race of carp lacking pelvic fins**—David H. Thompson and Leverett A. Adams.
12. **Notes on egg capsules of the Canadian Atlantic skates belonging to the genus Raja**—Vadim D. Vladykov.
13. **Osteology of Rhinophrynus dorsalis**—Charles Walker.
14. **An interesting observation on Bufo fowleri**—F. H. Stoye.
15. **The scientific name of the smooth green snake**—Karl P. Schmidt.

The ANNUAL DINNER of the Society was held at the Michigan Union at 6:45 P.M. Following the dinner DR. RUDOLPH VON IHERING, who is in charge of all fisheries work in Brazil, gave a very entertaining talk dealing with the biological career of his father, Dr. Hermann von Ihering. Following this address the group adjourned to the WILLIAM L. CLEMENTS LIBRARY to view an interesting exhibit illustrating the early development of American ichthyology and herpetology. An attractive, descriptive pamphlet, which had been especially prepared in the Society's honor by Howard R. Peckham, Helen T. Gaige and Carl L. Hubbs, was distributed to the members at this time.

Sessions of September 1

THE meeting convened at 9:50 A.M. for the reading of the following papers:

16. **Is Inopsetta ischyra (Jordan and Gilbert), from Puget Sound, Washington, a hybrid flatfish?**—Leonard P. Schultz and Richard D. Smith.
17. **Some problems of herpetological investigation in southern Central America**—E. R. Dunn.
18. **Ovarian and embryonic characters calling for a reclassification of the Gooeidae**—C. L. Turner.

Business Session

ACTING-CHAIRMAN SCHMIDT called the annual business meeting to order at 11:15 A.M., when 44 members, including 13 Governors, were present. With the consent of the group the minutes of the previous meeting were dispensed with, since these had been published in COPEIA.

The SECRETARY reported that 72 new members were secured in the period of 16 months since the previous meeting; 3 members died during the period, 6 resigned, and 18 were dropped for non-payment of dues. These changes resulted in a net gain of 45 members thereby increasing the total membership to exactly 400. Twelve new subscribers were added during the period, and 2 were discontinued, which resulted in a net gain of 10 subscribers and increased the subscription list to 88. The total number of members and subscribers was 488 on September 1, 1936. This figure represented a gain of 55 over the previous total, and the highest total yet reached by the Society. A geographical analysis of the members and subscribers indicated that 82 copies of Copeia go to 19 foreign countries, with Canada leading with 23, and Great Britain and the U.S.S.R. following with 8 each. The domestic copies total 406, distributed in 43 states and the District of Columbia; 66 in New York, 51 in California, 35 in Michigan, and 28 in Massachusetts. The Society has neither members nor subscribers in Delaware, Nevada, Nebraska, North Dakota, and Vermont. The SECRETARY reported that the mimeographed list of members had been requested by only 20 members, far too small a number to justify repetition of this task.

In the absence of the TREASURER, the SECRETARY made a few unofficial remarks about the financial condition of the Society. Compared financial reports, on a calendar year basis, for 1935 and 1936 will be published by the Treasurer in a later number of COPEIA.

DR. HUBBS presented an informal EDITOR'S report, and Mrs. GAIGE supplemented his remarks by requesting that all members aid her by sending in news notes.

The SECRETARY, representing the Committee on Incorporation, announced that progress toward incorporation was being made, and that this should be accomplished in the next year. There were no reports from other standing committees. A motion was passed instructing the EDITORS to publish in COPEIA, at least once a year, a list of the standing committees of the Society.

The 72 new members proposed during the year were formally elected. The SECRETARY announced that an invitation for the 1937 meeting had been received from the St. Louis Zoological Park, and various supporting organizations, in St. Louis. Mr. CHUTE pointed out that the invitation received last year from the Shedd Aquarium was a standing invitation. After some discussion Dr. DUNN moved that the time and place of the 1937 meeting be decided by a vote of the Board of Governors. This motion was seconded by Dr. SCHULTZ and duly carried.

Dr. Myers proposed that the amendment to Article III, Section 1, of the By-Laws, be amended by the substitution of "Honorary Foreign Members" for "Honorary Members" and by the addition of this sentence, "The prescribed number of Honorary Foreign Members shall be chosen annually by the Board of Governors." After discussion this amendment was passed unanimously. It was suggested that the EDITORS consider listing the names of Honorary Foreign Members in COPEIA in conjunction with the list of officers.

In order to fill existing vacancies in the Board of Governors the following members ware unanimously elected: Mr. E. MILBY BURTON, Dr. JEAN M. LINSDALE, Dr. WALTER MOSAUER, Dr. LUIS HOWELL RIVERO, Mr. F. H. STOYE, Dr. ARTHUR SVIHLA, and Mr. PERCY VIOSCA, Jr.

Dr. WALKER moved that, in view of the secretarial assistance provided for the Society by the Museum of Zoology and the Carnegie Museum, each of these institutions be allowed 2 subscriptions to COPEIA annually to be used for exchange purposes only, and only with institutions not at present on the subscription list. After discussion this motion was amended to allot 2 similarly restricted subscriptions to each of the EDITORS, and to the SECRETARY. This motion was carried.

A motion was passed empowering the incoming President to appoint a STANDING COMMITTEE ON CONSERVATION. This Committee is to be authorized to act upon Conservation matters, between meetings, in the name of the Society, and it must include at least one herpetologist.

The Resolutions Committee, consisting of Dr. Myers, Dr. Dymond, and Dr. Mosauer, presented the following resolutions which were unanimously adopted:

Be it resolved that the American Society of Ichthyologists and Herpetologists declares itself to be in favor of furthering popular interest in the study of cold-blooded vertebrates. To this end, the members of the Society are urged to stimulate such interest in the public schools, youth organizations, and civic organizations through lectures, exhibits, and popular writings. It is hoped that such measures may yield a new crop of young and promising students in our fields.

Whereas, the supply of the California sardine is seriously threatened by the unrestricted activities of floating reduction plants, and *Whereas* this species supports a great commercial fishery yielding a large food supply, and indirectly sustains an important sport fishery for game fishes which feed upon the sardine, *Therefore, Be it Resolved,* that the American Society of Ichthyologists and Herpetologists favors congressional action which will make possible the perpetuation of this most valuable supply through research and through regulations based on scientific investigation.

The Nominating Committee, which consisted of Dr. Schultz (chairman), Dr. Dunn, and Dr. Walker, presented its report. The officers nominated for the ensuing year were: LEONHARD STEJNEGER and JOHN T. NICHOLS, *Honorary Presidents;* W. K. GREGORY, *President;* K. P. SCHMIDT, J. R. DYMOND, and F. N. BLANCHARD, *Vice-Presidents;* M. GRAHAM NETTING, *Secretary;* A. W. HENN, *Treasurer;* CARL L. HUBBS and HELEN T. GAIGE, *Editors.* There were no additional nominations, and the proposed officers were elected unanimously.

The business meeting was adjourned at 12:15 P.M., and the members gathered at the Michigan League for a complimentary luncheon provided by the University of Michigan. The afternoon session convened at 2:00 P.M. for the reading of the following papers:

19. **Motion pictures of Reelfoot Lake, with discussion of ichthyological and herpetological work at the Reelfoot Lake Biological Laboratory**—C. L. Baker and Malcolm V. Parker.
20. **Remarks on the herpetology of eastern Arkansas and western Tennessee**—Malcolm V. Parker.
21. **Some dens of the rattlesnakes, Crotalus confluentus** (with motion pictures)—A. M. Woodbury and J. W. Sugden.
22. **Notes on the breeding habits of Belontia signata (Günther), an anabantid fish from Ceylon**—F. H. Stoye.
23. **Observations on maskinonge in a stream flowing into Lake Huron**—E. Seaborn.
24. **The value of the characters of the gonopodial suspensorium in the classification of the Poeciliidae**—Luis Howell Rivero and Carl L. Hubbs.
25. **The bearing of sexual dimorphism on the classification of the Ameiuridae**—Milton B. Trautman.
26. **The forms of Natrix erythrogaster and N. sipedon**—William Clay.
27. **The status of Crotalus unicolor van Lidth de Jeude and C. pulvis Ditmars**—Howard K. Gloyd.
28. **A short study of Ontario woodfrogs**—E. B. S. Logier.
29. **Reptiles of sand deserts**—Walter Mosauer.

At the close of the afternoon session the Resolutions Committee presented the following resolution which was unanimously approved:

Whereas, the present meeting has been the most successful in the history of this Society, *Therefore, Be it Resolved* that the American Society of Ichthyologists and Herpetologists expresses its deep gratitude to the Regents of the University of Michigan, to the staff of the Museum of Zoology, and to the authorities of the William L. Clements Library for the kind reception and hospitality tendered to its members on the occasion of its Nineteenth Annual Meeting.

At the close of the meeting the registration list contained 111 names—the largest attendance ever recorded at an annual meeting.

Herpetological News Notes

DR. LEONHARD STEJNEGER, our beloved Dean of American Herpetology, celebrated his 85th birthday on Friday, October 30th. On this occasion his museum friends honored Dr. Stejneger by presenting to the U. S. National Museum, in his name, the portrait which was painted of him recently.

Dr. HOWARD K. GLOYD, of the Department of Zoology, University of Michigan, has been appointed Director of the Chicago Academy of Sciences.

Ichthyological Items

DR. LEONARD P. SCHULTZ of the School of Fisheries, University of Washington, has been appointed Assistant Curator in charge of the Division of Fishes, United States National Museum, in place of Dr. George S. Myers who has returned to Stanford University. Dr. Schultz will take on his new duties in December, with the good wishes of all American ichthyologists.

A Museum of Natural History has been organized at the University of Oregon, including the Museum of Zoology. It is hoped that museum work at Oregon may be expanded.

Dr. T. WAYLAND VAUGHN has retired as Director of the Scripps Institution of Oceanography of the University of California, and his place has been taken by Dr. HARALD U. SVERDRUP.

LEONARD GIOVANNOLI has taken over the position of Supervisor of the Key West Aquarium, while E. LOWE PIERCE is doing graduate work in marine biology at the University of Liverpool.

Progress is reported on the list of British Columbia fishes being prepared by W. A. CLEMENS and G. V. WILBY. The latter has accepted for the year, a position in the zoology department at the University of Alberta.

Dr. ARTHUR SVIHLA, Secretary-Treasurer of the Western Division of the American Society of Ichthyologists and Herpetologists, left in August with Mrs. Svihla for a trip around the world.

Dr. G. J. LINDBERG, Chief of the Division of Fishes, Zoological Institute, Academy of Sciences, Leningrad, U.S.S.R., has asked aid, through Dr. Leo Shapovalov of Stanford University, in securing a copy of part 2 of Jordan and Evermann's *Fishes of North and Middle America*. Dr. Shapovalov has an extra copy of part 2 which he would like to exchange for one of part 3.

Mr. GORDON GUNTER, formerly with the U. S. Bureau of Fisheries, is now employed, as Zoologist and Superintendent of Production, by the Texas Oyster Development Corporation, at Houston.

Another life has been lost in the service of fisheries research. On September 16, English-born JOHN ALEXANDER STEVENSON, 23-year-old graduate of Queen's University, was drowned near Port Wade, Nova Scotia, while experimenting with his newly designed scallop rake. At the time, he was employed by the Biological Board of Canada, and was about to return to the University of Toronto to continue his graduate work.

Dr. JOHN PEASE BABCOCK, formerly Deputy Commissioner of Fisheries for British Columbia, well known as an early sponsor of fisheries research, died on October 12 at the age of 80.